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Supreme Court, U.S.
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No. 95-1096

In The

# Supreme Court of the United States

October Term, 1995

MICRON SEPARATIONS, INC.,

*Petitioner,*

v.

PALL CORPORATION,

*Respondent.*

**On Petition For A Writ Of Certiorari To The United States Court Of Appeals For The Federal Circuit**

## RESPONDENT'S BRIEF IN OPPOSITION

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## COUNTER-STATEMENT OF QUESTIONS PRESENTED

Respondent Pall Corporation is dissatisfied with petitioner's statement of questions presented, and, in accordance with Supreme Court Rule 24.2, presents this counter-statement:

1. In a patent infringement action in which an accused product is admittedly an equivalent of the patented product, do statements by the patentee to the patent examiner that were not made to distinguish the prior art, and were not accompanied by any amendments to the patent claims, give rise to an estoppel that bars the application of the doctrine of equivalents?

2. In a patent infringement action where the award of damages under 35 U.S.C. § 284 must be "adequate to compensate for the infringement," did the appellate court err in holding that a product that was the subject of ongoing infringement litigation was not an acceptable non-infringing alternative and in awarding lost profits accordingly?

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## RESPONDENT'S BRIEF IN OPPOSITION

Respondent Pall Corporation ("Pall") respectfully submits that a writ of certiorari should not issue in this action. Micron Separations, Inc. ("MSI") has presented no reason, other than that it was adjudged and affirmed to be an infringer of a patent, why the Court should exercise its certiorari jurisdiction in this matter.

This case was before the Court of Appeals for the Federal Circuit for four years. The court had the appeal briefed and argued twice, once before a regular panel and again *en banc*. It then remanded the matter back to the original panel which issued its decision unanimously. MSI cannot possibly complain that the appellate court did not carefully and at great length consider this appeal.

MSI argues that the principal question presented in this case concerns the patent law's doctrine of equivalents. It does not. The issue MSI chose to present to both of the lower courts, and which the courts ruled upon, was the applicability of the doctrine of prosecution history estoppel. MSI had not previously contested that the adjudged product and process were in fact technologically and legally equivalent to the patented product and process. Indeed, it assured the appellate court that it did "not challenge here on appeal any of the district court's underlying findings of fact regarding infringement." Supp. App. 94a.[1]

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[1] Page references to the appendix attached to petitioner's brief are indicated as "Pet. App. ___." Page references to petitioner's brief are indicated as "Pet. Br. ___" and references to the supplemental appendix attached hereto are indicated as "Supp. App. ___."

Petitioner's damages arguments are equally deficient. The appellate court's lost profits award is based on properly admitted evidence and sound legal precedent establishing that a third party's product subject to ongoing infringement litigation cannot be an acceptable non-infringing alternative.

Because no questions worthy of the exercise of the Court's certiorari jurisdiction have been presented and because the decisions below are in all respects correct, the petition should be denied.[2]

## OPINIONS BELOW

Pall notes that MSI has failed to comply with Supreme Court Rule 14.1(i)(i) regarding the requirement to include in the appendix the lower court opinions which are sought to be reviewed. Accordingly, under Supreme Court Rule 24.2, Pall submits the following:

Pall agrees that the Court of Appeals opinion is reported at 66 F.3d 1211 (Fed. Cir. 1995). Contrary to MSI's assertion, however, the district court opinion reviewed by the Court of Appeals is reported at 792 F.Supp. 1298 (D. Mass. 1992), and has not been included in MSI's appendix.

The opinion reproduced by MSI in its appendix is only the preliminary decision rendered by the district court from the bench in June, 1991 immediately following

[2] Pursuant to Supreme Court Rule 29.6, Pall states that it does not have any parent companies or subsidiaries other than wholly owned subsidiaries.

the trial. At that time, the court specifically reserved the "option of rendering a full written opinion." Supp. App. 1a. Such full written opinion was then issued as a slip opinion in April, 1992 and published shortly thereafter. It is reproduced in the supplemental appendix attached hereto. Pall's cited references in this brief are to the published opinion and are followed, where appropriate, with the citation to the preliminary decision included in MSI's appendix. While the two opinions are substantially alike, there are some differences in wording, grammar, organization, and emphasis.

At the time of publication of the district court's full written opinion, the appellate proceedings were still ongoing. While a first round of briefing and argument had been completed, the court ordered on November 5, 1993 that the case be heard *en banc*. Further briefs were filed and another argument was held. The Court of Appeals then referred the case back to the original panel which rendered its decision on September 26, 1995. In that opinion, the court not only referenced the full written published district court decision, *see* Pet. App. 5a ("slip op. at 1"), but also specifically denied MSI's motion to strike the published opinion, Pet. App. 23a-24a.

## STATUTORY PROVISIONS INVOLVED

Pall is dissatisfied with MSI's presentation of the statutory provisions involved in this appeal. Accordingly, under Supreme Court Rule 24.2, Pall submits that the following additional statute is involved in this case:

35 U.S.C. § 284 provides in pertinent part:

> Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interest and costs as fixed by the court.

## COUNTER-STATEMENT OF THE CASE

Pursuant to Supreme Court Rule 24.2, the following is presented to correct inaccuracies and omissions in the Statement of the Case by petitioner MSI:

### A. The Lower Courts' Determination of Infringement

The Pall patent in suit is directed to microporous membranes having certain properties and made of certain plastic materials, nylons, which contain "methylene" and "amide" chemical groups. Of greatest significance here are membranes made from nylons that have methylene to amide ratios of about 5:1 to about 7:1. The patent also covers a process for making such membrane. The trial court found, (Supp. App. 29a, Pet. App. 60a), and the appellate court acknowledged, (Pet. App. 4a), that the inventor, Dr. Pall, was a pioneer in the field of nylon membrane technology.

The trial court also found that in making the infringing products, MSI had "made extraordinarily extensive use of that [Pall] patent in its own process." Supp. App. 76a, Pet. App. 93a. MSI made two infringing membranes,

one of a nylon with a methylene to amide ratio of 5:1 (nylon 66), and the other with a ratio of 4:1 (nylon 46). The district court held that both products and MSI's processes for making them infringed the Pall patent. Supp. App. 50a-51a, 59a, 61a-62a, Pet. App. 77a, 83a-84a, 9[illegible]a.

The MSI membrane made from the 5:1 ratio nylon was held to infringe the Pall patent literally. As to the membrane made from the 4:1 ratio nylon, the district court found, and the appellate court affirmed, that there was infringement under the doctrine of equivalents. The lower courts agreed that there was no substantial difference between MSI's 4:1 nylon membrane product and the patented nylon membrane:

> The Court finds that Nylon 46, as used by MSI, does in fact perform substantially the same function as nylons in the range of about 5 to 1 to about 7 to 1 methylene to amide groups. It performs in substantially the same way to achieve substantially the same result as the claimed device. Indeed, MSI in its advertising doesn't even point out the source of the nylon used, and claims itself that the two nylons do precisely the same thing. Supp. App. 61a-62a, Pet. App. 87a.

MSI did not appeal the correctness of these district court findings, nor has MSI ever contended that membrane made from the 4:1 nylon is *not* equivalent to the claimed membrane. Pet. App. 11a.[3] Rather, MSI

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[3] The issue identified by MSI for appellate review was: Did the district court err as a matter of law when it held that prosecution history estoppel did not apply to limiting

argued to the Court of Appeals, as it had to the district court, that a statement made by Pall during the prosecution of the patent created an estoppel that rendered the doctrine of equivalents inapplicable. Pet. App. 11a-12a. Both lower courts rejected the argument based on well-established legal principles and because the facts simply did not support the contention.

The district court made extensive findings of fact regarding the prosecution history of the Pall patent, Supp. App. 18a-27a, Pet. App. 48a-55a, and the Court of Appeals reiterated those facts in its opinion, Pet. App. 11a-16a. Regrettably, MSI selected only certain of these facts for presentation in its petition for certiorari. It falsely suggests that Pall had amended its ratio claims to narrow their scope (*see, e.g.* Pet. Br. 9). In fact, as both of the lower courts found, the ratio range claims in the Pall patent were never amended at all. *See, e.g.*, Pet. App. 12a-13a. They were originally submitted to the Patent Office in the application that became the Pall patent (the "continuation-in-part application"), and were based on research done by Dr. Pall. Supp. App. 67a, Pet. App. 92a, 12a. The claims were allowed without change after the examiner withdrew an initial objection.

The principal ratio claim, No. 116, reads as follows:

> A hydrophilic skinless alcohol-insoluble hydrophobic polyamide resin membrane sheet
>
> of alcohol-insoluble hydrophobic polyamide resin having a ratio $CH_2$:NHCO of methylene

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35 U.S.C. § 112 enablement rejection. Supp. App. 94a. MSI did not seek review of the equivalents findings. Pet. App. 11a.

> $CH_2$ to amide NHCO groups within the range from about 5:1 to about 7:1;
>
> capable when completely immersed in water of being wetted through within no more than one second,
>
> and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water." Pet. App. 8a

Acknowledging that at the time the research was carried out, nylon 46 was not commercially available or "known" in the sense that Pall was required to carry out experiments (Supp. App. 66a-67a, Pet. App. 91a-92a, 16a) both courts below determined that Pall had not intended to abandon, nor did in fact abandon his claim to a workable nylon which fell outside the range of about 5:1 to about 7:1, so long as it was "within the penumbra of methylene to amide combinations which are 'about' that range." Supp. App. 67a, Pet. App. 92a.

In applying the well-settled law of prosecution history estoppel to these facts, which stand unchallenged by MSI, the district court found that there was no estoppel as to the ratio range claims. Supp. App. 62a-67a, Pet. App. 87a-92a. The Federal Circuit Court of Appeals affirmed these determinations. Pet. App. 16a.

### B. The *Hilton Davis* Petition Has No Bearing On This Case

The petition for a writ of certiorari in *Hilton Davis Chem. Co. v. Warner-Jenkinson Co.*, 62 F.3d 1512 (Fed. Cir. 1995) (*en banc*), *petition for cert. filed, Warner-Jenkinson Co.*

*v. Hilton Davis Chem. Co.*, (U.S. Nov. 6, 1995) (No. 95-728), is not relevant to this case. MSI has gone to great lengths to discuss alleged "similarities" between the cases in the Statement of the Case section of its petition. Indeed, much of MSI's statement is a word-for-word replication of the *Hilton Davis* petition. Two important facts distinguish this petition from the *Hilton Davis* petition, however. First, in the present case MSI did not contest in the Court of Appeals the district court's finding that the differences between the accused 4:1 ratio nylon membrane and the claimed product were "insubstantial", or that the 4:1 ratio nylon membrane performs substantially the same function, in substantially the same way, to achieve substantially the same result as the claimed product. Supp. App. 61a-62a, Pet. App. 87a, 11a. This case, as presented to the Court of Appeals for review, concerned the doctrine of prosecution history estoppel, and *not* the application of the doctrine of equivalents. Supp. App. 94a. In *Hilton Davis*, on the other hand, the issue of equivalency between the accused product and the claimed product was hotly contested in the Court of Appeals, and precipitated an opinion directed to that issue.

Second, in *Hilton Davis* the claims at issue were in fact narrowed by amendment to distinguish them from what other inventors had done earlier. *Hilton Davis*, 62 F.3d at 1515-16. Only then did the Patent Office allow them. The legal effect of such an *amendment* to overcome prior art is quite different from that of an *argument* that demonstrated to a patent examiner's satisfaction that the invention had been adequately described in the application papers. The similarities MSI sees between this case and the *Hilton Davis* case are strictly conjured up in an attempt to create substance for the petition where there really is none.

### C. The Law and Evidence Support the Award of 100% Lost Profits During The Period Of On-Going Patent Litigation

MSI finally contends that the appellate court should not have modified the damages award pursuant to Pall's cross-appeal. It takes issue with the appellate court's determination that Pall was entitled not just to 25% but to 100% of its lost profits prior to the availability of a non-infringing substitute. MSI wrongly contends that there was no factual record upon which the modified award may be based. It further misapprehends the applicable law.

The trial court had before it ample evidence of the unavailability of a non-infringing substitute. That evidence, testimonial and documentary, established the following:

1. Pall had accused the only even arguably similar membrane, made by Cuno, as an infringement. Supp. App. 95a.

2. From 1987 until May, 1990, Pall prosecuted its U.S. infringement claim in a civil action against Cuno. Supp. App. 95a.

3. Corresponding infringement suits had also been brought in foreign countries. One such action, in England, had progressed through a four week trial and a full determination of infringement. Supp. App. 96a-97a.

4. In May, 1990, Pall and Cuno settled their world-wide patent dispute. Under the settlement, Cuno obtained from Pall a covenant not to sue. Supp. App. 95a.

Contrary to MSI's representations in its petition, none of this evidence was excluded at trial. MSI had ample opportunity to rebut any or all of it, and to offer its own evidence that the Cuno membrane was an acceptable and available alternative. MSI presented no such evidence.

Refusing to formally adjudicate the infringement of the Cuno membrane when Cuno was not before the court, the district court, with MSI's support, excluded further evidence proffered by Pall establishing that the Cuno membrane in fact infringed. The court then awarded Pall its lost profits on only 25% of the infringing sales prior to the Settlement Agreement. Supp. App. 73a, Pet. App. 107a.

The Court of Appeals held that under the applicable law the presence of the accused Cuno membrane in the marketplace "did not defeat Pall's entitlement to lost profit damages," and that Pall was not required "to continue the Cuno litigation to judicial decision." Pet. App. 21a. It properly applied the law to the uncontested facts and awarded Pall all of its lost profits damages for the period prior to the Cuno settlement. Pet. App. 20a-22a.

Still misapprehending the law, MSI now argues that it should have been permitted to attempt to prove the non-infringement of the Cuno membranes. It wishes to ignore the fact that it itself objected to the presentation of trial evidence on the issue of the actual infringement. The Court of Appeals decision was in all respects correct.

## REASONS FOR DENYING THE WRIT

This case exemplifies the correct application of relatively plain and long-settled principles of patent law. The petition for certiorari should be denied because the decisions below are correct, because this is not an appropriate case to address the doctrine of equivalents, and because no extraordinary issues of law or public policy have been raised.

### A. The Lower Courts' Infringement Determinations Are Correct

MSI conceded that the specific factual determinations and conclusions of law by the lower courts regarding infringement are correct. Supp. App. 94a. It does not dispute that the district court construed the claims as a matter of law, applied those claims to the accused product and method, and found the literal presence of each claimed element, save only the "about 5:1" ratio element.

The question then became whether in the context of a membrane having all of the other required attributes of the patent claim (see claim 116, *supra*, p. 6), a nylon 46 material having a ratio of 4:1 was equivalent to a nylon material having a ratio of "about 5:1." The district court applied the long-standing tripartite test of *Graver Tank* and held that the differences were "insubstantial" and that the two products were "substantially the same." Supp. App. 61a-62a, Pet. App. 87a. MSI's own documents supported that finding and MSI did not challenge it on appeal. The district court properly concluded that, absent prosecution history estoppel, there was infringement. Supp. App. 62a, 67a, Pet. App. 87a, 92a.

The trial court held that there was no such estoppel. Supp. App. 67a, Pet. App. 92a. It found that the inclusion in the description in the patent claims of nylon resins "within the range of about 5:1 to 7:1" was not based upon prior art or any requirement by the patent examiner, Supp. App. 26a, Pet. App. 55a, and that in response to a § 112 rejection, the applicant pointed out, without amending the claims, that they were "actually rather narrow." Pet. App. 156a. This statement was based upon the scientific knowledge at the time relating to the limited number of "known" nylons which produced membranes with the properties claimed in the patent. *See*, Supp. App. 66a-67a, Pet. App. 92a.

MSI has not alleged error by either the district court or the Court of Appeals regarding the factual findings relating to prosecution history estoppel. According to its own appellate brief:

> MSI does not challenge here on appeal any of the district court's underlying findings of fact regarding infringement. Therefore, . . . it is unnecessary for this Court to set aside any probative findings of fact found by the district court or to engage in any reweighing of the evidence in this case. Supp. App. 94a.

Nor did it "argue . . . that the nylon 46 and nylon 66 membranes are not equivalent." Pet. App. 11a. Only now does it contend that the claims were somehow "narrowed" by claimant's comment (Pet. Br. 9, 11), and that the claims were then improperly enlarged under the doctrine of equivalents (Pet. Br. 15). However, the law is well-settled, that, as the Federal Circuit stated:

> Whether amendment or argument made in response to a rejection under § 112 produces an estoppel, as does an amendment made to obtain allowance in view of cited references, is dependent on the particular facts. There is no all-encompassing rule that estoppel results from all claim changes, or all arguments, whatever their cause or purpose. *Laitram Corp. v. NEC Corp.*, 952 F.2d 1357, 1361 (Fed. Cir. 1991); *Hi-Life Products, Inc. v. American National Water-Mattress Corp.*, 842 F.2d 323, 325 (Fed. Cir. 1988).

Pet. App. 14a. Each case must be reviewed on the specific facts surrounding the argument. *See, Sun Studs, Inc. v. ATA Equipment Leasing, Inc.*, 872 F.2d 978, 987 (Fed. Cir. 1989); *Moeller v. Ionetics, Inc.*, 794 F.2d 653, 659-60 (Fed. Cir. 1986); *Mannesmann Demag Corp. v. Engineered Metal Products Co.*, 793 F.2d 1279, 1285 (Fed. Cir. 1986); *Caterpillar Tractor Co. v. Berco, S.p.A.*, 714 F.2d 1110, 1115 (Fed. Cir. 1983). Pet. App. 15a.

Under the undisputed facts in this case, the lower courts properly concluded that applicant's argument did not create an estoppel. MSI has failed to present a single fact or single case which even challenges, much less contradicts, any of the determinations below. Its broad allegations of "violation of statutory policy" and "improper exercise of judicial power", Pet. Br. at 15, 16, are simply unjustified. The petition for certiorari should be denied.

**B. This Is Not the Appropriate Case for Reconsideration of the Doctrine of Equivalents**

Even though this is plainly not a doctrine of equivalents case, MSI urges that the Court seize upon this case to rewrite or eliminate more than 100 years of doctrine of equivalents law, including the almost 50 years of clear precedent in *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605 (1950). Its submission is essentially an *amicus* brief supporting the petition for certiorari in *Warner Jenkinson Co. v. Hilton Davis Chem. Co.*, No. 95-728, filed Nov. 6, 1995. It is not an attempt to seek review of specific rulings actually made by the lower courts in *this* case.

This is plainly not the right case for a reexamination of the doctrine of equivalents. At no time in the proceedings below did MSI put forward any evidence or argument in support of its present proposition that the doctrine of equivalents be eliminated, at least as we know it presently. At no time did MSI even seriously argue, let alone present any evidence, that the infringing membrane was not equivalent to the patented membrane. MSI wishes to have this Court convert the case from the prosecution history estoppel case that it was throughout the lower court proceedings to a doctrine of equivalents case that it never was and, under the present state of the record, can never be. This Court would be poorly served by the record in this case were it to undertake a reexamination of the doctrine of equivalents. MSI's petition should be denied for this reason alone.

### C. There Is No Reason to Tamper with the Doctrine of Equivalents

Perhaps most importantly, this Court should deny MSI's petition for certiorari because the doctrine of equivalents needs no overhaul in any event. It has served inventors, industry and society as a whole with great distinction for more than 100 years. And it is not, as MSI seems to suggest, suddenly gone out of control.

The doctrine is in fact necessary to effectively protect intellectual property rights and foster innovation and technological advance. Courts have applied it repeatedly for more than a century and Congress has wisely never intervened. "[T]he greater complexity of today's patented high technology inventions," *Hilton Davis*, 62 F.3d at 1549 n.3 (Lourie, J., dissenting), renders the doctrine not obsolete, but of even greater importance than ever before. Inventors must be protected against unscrupulous infringers.

At the same time, Pall fully accepts that there must be limitations and predictability in the scope of a patent and the application of the doctrine of equivalents. And there is. Both Congress and the courts have put in place numerous restrictions against the indiscriminate broadening of patents. For example, 35 U.S.C. § 112 requires that patent claims be definite and supported in a patent's specification, and the reissue provision of the Patent Act, 35 U.S.C. § 251, permits the broadening of patent claims only within two years of the issuance of the patent. Similarly, courts have ruled that reexamined claims cannot be broader than the original claims, *Quantum Corp. v. Rodime, PLC*, 65 F.3d 1577 (Fed. Cir. 1995), and, as yet

subject to review by this Court, that the meaning of patent claims is a question of law not to be left to presumably unpredictable juries, *Markman v. Westview Instruments, Inc.*, 52 F.3d 967 (Fed. Cir.) (*en banc*), *cert. granted*, 64 U.S.L.W. 3238 (U.S. Sept. 27, 1995) (No. 95-26).

The doctrine of equivalents does not clash with these policies and objectives. It also is narrowly circumscribed. Under *Graver Tank, supra*, and its progeny such as *Hilton Davis, supra*, only in those rare instances where the difference between an accused and a patented product is "insubstantial," and only in the absence of prosecution history estoppel, does the doctrine operate to result in infringement. That has been the law for decades, and MSI has failed to show any reason why this Court should revisit the matter.

### D. The Federal Circuit's Lost Profits Award Is Supported by Evidence And Long Established Precedent And Raises No Issue Worthy of This Court's Consideration

MSI asks that this Court review the appellate court's recalculation of damages. It contends that the lower court was without evidence and legal authority to do so. No other reason for a grant of certiorari is offered. MSI's request should be denied because it is unsupported by law or fact. The lower court in fact had sufficient evidence and ample legal support for its actions.

MSI argues that an express adjudication of infringement is required in order to establish the absence of acceptable non-infringing alternatives for a lost profits

award. Pet. Br. 16. As the trial court excluded certain evidence of actual infringement of the Cuno membrane, MSI contends that there is no evidence to support the appellate court's award. MSI does not contest that Pall established all other requirements for the award of lost profits, as well as the facts of the prior charge of infringement against the Cuno membrane, extended infringement litigation between Pall and Cuno involving that membrane, and the ultimate settlement of that litigation and Pall's grant of a covenant not to sue Cuno.

Under prevailing law, that evidence is in fact sufficient to support an award of lost profit damages. Pall needed only to show a *reasonable probability* that, but for the infringement, it would have made the sales that were made by MSI. *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538, 1545 (Fed. Cir. 1995) (en banc); *Beatrice Foods Co. v. New England Printing and Lithographing Co.*, 899 F.2d 1171, 1173 (Fed. Cir. 1990) (Pet. App. 103a, 20a).

It is clear that a "likely infringer" cannot provide an acceptable non-infringing alternative, *State Industries, Inc. v. Mor-Flo Industries, Inc.*, 883 F.2d 1573, 1578 (Fed. Cir. 1989), *cert. denied*, 493 U.S. 1022 (1990); *Micro Motion, Inc. v. Kane Steel Co.*, 894 F.2d 1318, 1322 (Fed. Cir. 1990). Similarly, courts have held that on-going litigation cannot support a finding of an acceptable non-infringing alternative. *Datascope Corp. v. SMEC, Inc.*, 879 F.2d 820, 824-25 (Fed. Cir. 1989), *cert. denied*, 493 U.S. 1024 (1990). Pet. App. 21a-22a.

The Court of Appeals did have ample evidence to support its judgment, *i.e.* the existence of the infringement charge, on-going litigation, and the settlement

agreement, establishing the likely infringement by the Cuno membrane. The fact that MSI chose not to introduce any rebuttal evidence simply reflects the irrefutable nature of Pall's evidence, and was in any event a decision made by MSI. It should not now be heard to protest that it never had a reason or an opportunity to introduce rebuttal evidence. Pet. Br. 16.

MSI seeks a remand requiring the district court to do that which case law expressly does not require. The Court of Appeals had adequate facts and correctly applied well-established and uncontroversial law in modifying the lost profits award. There is no reason why MSI's petition for a writ of certiorari should be granted.

## CONCLUSION

For the reasons stated above, respondent Pall Corporation, respectfully requests that MSI's Petition for a Writ of Certiorari be denied.

Respectfully submitted,

Dated: February 9, 1996

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UNITED STATES DISTRICT COURT FOR THE DISTRICT OF MASSACHUSETTS

| | | |
|---|---|---|
| PALL CORPORATION, Plaintiff, | ) | |
| v. | ) | CIVIL ACTION No. 86-1427-Y |
| MICRON SEPARATIONS, INC., Defendant. | ) | |

MEMORANDUM OF DECISION[1]

YOUNG, D.J. April 24, 1992, Decided

This case involves United States Patent 4,340,479 (the "Pall patent") covering a process for preparing hydrophilic polyamide membrane filtered media and product, which issued on July 20, 1982 to the plaintiff Pall Corporation ("Pall"). Pall is a New York corporation having a principal place of business in Glen Cove, New York, and offices on Route 25A in Roslyn, New York. Pall was founded in the late 1940's by Dr. David B. Pall of Roslyn Estates, New York. Dr. Pall is designated as the inventor of the patent-in-suit.

The action is brought against the defendant Micron Separations, Inc. ("MSI"), a Massachusetts corporation having a principal place of business in Westborough, Massachusetts. MSI was formed in 1981 when certain employees of a filtration company known as Millipore, specifically James S. Johnson and John M. Greenwood,

[1] The Court rendered its decision in this case from the bench on June 5 and June 20, 1991, reserving the option of rendering a full written opinion. This is that opinion.

left that company and, along with Edward J. Ackley, decided to start their own company and enter into competition with Pall, Millipore, and others in the microporous filtration industry.

The complaint in this action was filed on May 7, 1986. It seeks a judgment that MSI has willfully infringed the Pall patent. The complaint also seeks damages for past infringement and an injunction against future infringement.

## I. Prior Art

### A. The general setting.

At this juncture it's helpful to put some matters in perspective. Polymeric membranes are thin, sheet like materials with very small interconnected pores. The pores usually range in size from about one-tenth of a micron to ten microns. The membranes are made from a chemical material that has many thousands of repeating units, a polymer. There are many such materials, many methods for making them into membranes, and many uses for such membranes.

Polymeric membranes, in the strictest sense of the word, may be fibrous or non-fibrous. Usually, however, when the term polymeric membrane is employed, the non-fibrous type is meant. Non-fibrous membranes are usually made directly from a solution or melt of the polymer. Fibrous polymeric membranes are made by first converting the polymer into fibers, and then making a thin web from those fibers. Potassium titanate is a good example of a fibrous polymeric membrane.

Prior to the development of the Pall nylon membrane, fibrous filter media, made, for example, from potassium titanate or asbestos, were commonly employed as filtration medium. At the present time, the two most commonly used microfiltration membranes are Pall's nylon membrane and Millipore's PVDF membrane, both made from non-fibrous polymers. They are employed mainly in the filtration of liquids to remove very small particles, including bacteria, a process known as microfiltration.

Typical filtration applications include use by pharmaceutical companies to assure that the drugs they make are free of bacteria contamination, use by electronic companies to purify water for chip manufacture, and use by hospitals to assure that the fluids administered to patients are free from bacteria and other contaminants. Typical biotechnological applications include use in diagnostics to detect the presence of antibodies and the so-called transfer membranes for identification of genetic characteristics.

Depending upon their use, polymeric membranes may have a skin on them, or they may be without a skin. Certain processes, reverse osmosis, for example, require the presence of a continuous skin, while in other processes microfiltration, for example, the complete absence of any skin is necessary.

Microfiltration is one of the most common applications for polymeric membranes at this time. It is, however, by no means the only application. Membranes are also used in reverse osmosis, electrophoresis, dialysis, electrodialysis, gas separation, and immobilization and

transfer of substances. Microfiltration is the regime with pores between about one-tenth of a micron and 10 microns. The most important pore size is .2 microns because this is the pore size that gives the highest flow rates and throughputs consistent with the retention of the approximate .3 micron Pseudomonas diminutia bacteria which is the criterion for a pore size rating equivalent to sterilization. Today commercially acceptable microfiltration membranes are skinless and macrovoid-free and have a narrow pore size distribution which maximizes their efficiency at removing bacteria, and other particulate matter of equivalent size, from fluids.

Other uses for microfiltration membranes are now found more and more in the biotechnology area. Polymeric membranes are there employed, for example, to hold certain substances such as antibodies, antigens or other proteins while blood or other body fluids are passed through the membrane.

Over the years, many different polymers have been investigated as possible membrane media in a number of different applications. By the late 1970's, the list included the following, without any attempt to be exhaustive:

| Polymer | Application |
|---|---|
| Cellulose acetate and nitrate including mixtures | Electrophoresis<br>Microfiltration<br>Ultrafiltration<br>Reverse Osmosis<br>Gas Separation |
| Cellulose triacetate | Microfiltration<br>Ultrafiltration<br>Reverse Osmosis |

| | |
|---|---|
| Cellulose acetate/triacetate blends | Reverse Osmosis |
| Polyacrylonitrile | Ultrafiltration |
| Polyacrylonitrile-polyvinyl-chloride copolymer | Microfiltration |
| Polyamide (incl. various nylons) | Microfiltration<br>Ultrafiltration<br>Reverse Osmosis<br>Immobilizing Medium |
| Polyaryl Sulfone | Ultrafiltration |
| Polycarbonate | Microfiltration<br>Reverse Osmosis<br>Electrophoresis |
| Polyester | Microfiltration |
| Polyether Sulfone | Ultrafiltration |
| Polyimide | Ultrafiltration<br>Reverse Osmosis<br>Microfiltration |
| Polypropylene | |
| Polysulfone | Microfiltration<br>Ultrafiltration |
| Polytetrafluoroethylene (PTFE) | Microfiltration |
| Polyvinylchloride | Microfiltration |
| Polyvinylidenefluoride (PVFD) | Microfiltration<br>Ultrafiltration |

Dr. Kesting Direct Testimony at 7.

By 1978, many methods had been investigated for making the polymers mentioned above, and many other polymers not here mentioned in porous membranes. They included: casting membranes from a melt of the polymer; casting from a polymer solution into an evaporative

atmosphere; casting from a polymer solution into a non-solvent liquid; stretching semi-crystalline films; thermal gelling by decreasing the temperature of the polymer solution; inducing porosity by irradiation of polyester and/or polycarbonate films; binding the polymer into a thin sheet structure by sintering.

In 1978, the leading manufacturers of microfiltration media were Pall with its fibrous potassium titanate product, and Millipore with its membrane made of a mixture of cellulose nitrate and cellulose acetate. Several other membrane products were on the market, but none had any significant market share. Most, if not all, of the polymeric non-fibrous membranes were made by a process that involved casting from a solution followed by evaporation or quenching in a liquid.

Pre-1978 filter media, fibrous and non-fibrous, suffered from one or another of the following deficiencies: brittleness, unless highly plasticized they could not be pleated and incorporated into a cartridge; marginal thermal stability, the membrane shrank excessively while being sterilized with steam; high extractables, the surfactants employed to render the membranes hydrophilic so that they could be used with acqueous fluids and the plasticizers required to permit the membranes to be made into useful products leached out of the membrane while in use; poor solvent resistance, the membranes softened or dissolved when used in certain solvents; limited flowrate, the amount of liquid per unit time capable of flowing across the membranes was limited; limited throughput, the membranes clogged easily and thus had to be exchanged frequently; limited sterilizing ability, the membranes could not consistently produce bacteria-free

fluids; poor dimensional stability, the membranes swelled in water; danger of fiber sloughing into the permeate, unless specially treated fibrous materials tend to slough off fibers into the permeate.

By 1978, the industry had recognized the desirability for a new type of membrane and had pursued many avenues of reaching that goal. All such attempts had failed.

B. The efforts of Paul J. Marinaccio.

Analysis starts not with the Pall patent but with the prior art, more specifically, a patent referred to in this lawsuit as the Marinaccio patent.

Paul J. Marinaccio was hired as a research chemist by AMF Corporation ("AMF") to make reverse osmosis membranes. AMF is a large corporation. It has 80 divisions, but has largely centered research and development within AMF itself. Cuno, a subsidiary of AMF, sought to have the AMF research chemists develop a microfiltration fiber filter. Marinaccio and others commenced work on this project, but Marinaccio serendipitously embarked upon microporous membrane research when it occurred to him as he looked at his polystyrene coffee cup that it might be possible to make microporous membranes out of related materials.

Marinaccio thereupon devised an experimental process involving the dissolving of nylon pellets in formic acid which he believed was a breakthrough in that it allowed the rapid manufacture of microporous membranes. In the late 1960's and early 1970's when he was

performing these experiments, Marinaccio knew that no one else in the industry had such a rapid commercial process.

Abandoning their work on the microfiltration fiber filter, Marinaccio and his colleagues instead devoted their efforts to the development of a microporous membrane. Marinaccio believed that the key to the development of microporous membranes was a device which prevented any air contact during the quench process. He called this aspect of his claimed invention zero quench. The general steps for making microporous membranes were, by the early 1970's, well known to those skilled in the art of making such membranes. To the extent that Marinaccio's process incorporates new developments in the art of making microporous membranes, they are developments in the particular materials used and the manner of their use rather than in the mechanical aspects of the membrane process.

Marinaccio sought, and received, United States Patent 3,876,738 (the "Marinaccio patent") dated April 8, 1975. The Marinaccio patent described the so-called zero quench process for the continuous formation deposit of membrane so as to form large sheets of microporous membranes.

Although Marinaccio had obtained a patent on his invention, he had a number of problems within his company. Marinaccio believed that his patented process had significant commercial viability but, as is the pliant of inventors everywhere, he considered himself starved for money and thought that the business leaders at AMF did

not support his research efforts adequately. He characterized the microporous membrane research laboratory at AMF as filled with equipment literally held together with wire and tape. Marinaccio, through the use of his invention, was able to manufacture sheets of microporous membrane which looked identical to the naked eye. That process was able to make short runs of .2 micron material. Marinaccio claims that long runs were not made because he did not have the money to develop the machinery capable of making long runs. Marinaccio believed and indeed still believes, that he could have made long runs by his process had he adequately been supported.

Marinaccio believed that his only failure was the equipment limitation failure. Marinaccio, however, recognized the problems with the long-term reproducibility of the materials formed by his process. He further recognized that the most critical test for microporous membrane is the bacteria retention test and that, in ways that he was never satisfactorily able to explain, various of his prototype production runs failed to meet the bacteria retention test. Marinaccio ran bubble point tests and flow tests on these materials that he had manufactured and, from those tests, he came to believe that microporous membrane manufactured pursuant to his process was as good for microfiltration purposes as anything then commercially available.

A gentleman named Ostricher at Cuno was very enthusiastic about the samples which Marinaccio had produced. Ostricher compared those membrane samples with the standard Cuno counterpart and concluded that the Marinaccio samples were considerably better.

The trouble came in the commercialization of the Marinaccio process. Marinaccio's concept for the commercialization of his process was to design an idiot-proof process for making membranes; that is, he constantly sought a simple, readily understandable, generally applicable approach. Cuno, at that time, made only unsophisticated paint filters. The chief executive officer of Cuno was one Ray Tritten. Tritten's idea of commercialization of microporous filters was a process that resulted in long runs of membrane sheets. While certain of his subordinates thought that the sheets prepared by the Marinaccio process were good enough for commercial application, Tritten disagreed. The results of tests conducted with tap water made Tritten concerned that the filters prepared by the Marinaccio process had a very short life. Marinaccio believed that the short life showed nothing more than the remarkable benefits to be derived from his filter inasmuch as it filtered everything out of the tap water retaining it on the filter face and quickly clogging the filter.

Tritten's rejection of Marinaccio's efforts to commercialize the Marinaccio process as set forth in the patent and AMF's confirmation of that rejection did not daunt Marinaccio. He continued testing it covertly. Cuno did not sell any of the rolls of the membrane material developed pursuant to the Marinaccio patent.

C. The Marinaccio patent.

The Marinaccio patent does not contain any indication that the products obtained by its process are skinless or hydrophilic, as that term is used in the Pall patent. The Marinaccio patent is silent with respect to skinlessness. It

comments only that a person of ordinary skill in the art ought to recognize that a skin may result on the casting solution and therefore is likely on the final product after quenching. Not only does the Marinaccio patent not claim that the products produced are inherently hydrophilic as that term is used in the Pall patent, it further teaches that the products produced should be "treated with a wetting agent." The Marinaccio patent teaches that the process does not require special conditions of temperature. The films can conveniently be produced at or near room temperature. In fact, temperature plays an important role in the preparation and casting of a resin to form a membrane. Because of this, Rodney A. Knight, an inventor who assisted Marinaccio in the development of the zero quench process that is referred to in the Marinaccio patent, later came to think temperature was a significant variable in getting exact pore size control but not, thought Knight, absolutely essential to the preparation of the microporous membrane itself. The Marinaccio patent does not disclose that control of the esterification reaction resulting from the order in which the reagents are added to form the casting solution is important and affects the resulting product. The Marinaccio patent does not indicate any importance in the mixing conditions employed in making the casting resin. The Marinaccio patent teaches that increased porosity is obtained by increasing the polymer concentration to the solution and by increasing the nonsolvent concentration causing the polymer to aggregate. The Marinaccio patent is silent regarding the manner in which the membrane film that is produced is dried. It makes no mention of controlled nucleation.

Marinaccio's patent claims polystyrene as a workable substance. In fact, polystyrene can never be made into a membrane with a zero contact angle which meets the definition of hydrophilic, as the term is used in the Pall patent. Marinaccio did not distinguish between amorphous and crystalline polymers.

D. Abandonment by Cuno.

Wholly apart from the claimed anticipation of the Pall patent by the Marinaccio patent, MSI here claims that the invention of the Pall patent, the microporous membrane itself, had been reduced to practice by virtue of the rolls of microporous material which Marinaccio produced for Cuno. Pall disagrees, claiming that the Marinaccio efforts were abandoned, suppressed or concealed by not being made public. A brief analysis need be made of this issue.

If a prior invention is made public or is used commercially it has not been abandoned. *Friction Div. Prod., Inc.* v. *E.I. DuPont de Nemours & Co.*, 658 F. Supp. 998, 1014 (D. Del. 1987, 3 U.S.P.Q.2D (BNA) 1775), *aff'd*, 883 F.2d 1027 (Fed. Cir. 1989). The law does not require any disclosure of the actual invention to the public nor any commercial use for an invention to qualify as prior art. *Hazeltine Research, Inc.* v. *Brenner*, 382 U.S. 252, 254-56, 15 L. Ed. 2d 304, 86 S. Ct. 335, 147 U.S.P.Q. (BNA) 429 (1965). The invention need only benefit the public, that is, it must be reduced to practice. *Friction Div. Prod., Inc.*, 658 F. Supp. at 1013-14. Reduction to practice means something less than commercialization, but requires an exposure of the benefits to the public. *Id.* An invention is deemed

publicly known if the public enjoys the benefits or use of the prior invention. *Id.; see also Schreiber Mfg. Co., Inc. v. Saft America, Inc.*, 704 F. Supp. 759, 762 (E.D. Mich. 1989) (" '[P]ublic use' of an invention under sec. 102[b] is any nonexperimental use by an inventor or by an individual. . . . A commercial use by the inventor will bar a patent, even if that commercial use is kept secret. . . . The determination of whether a 'public use' has occurred can only be made upon consideration of all surrounding circumstances").

In the circumstances of this case, the Court finds that the rolls of material made by Marinaccio for Cuno were experimental only, never benefited the public, were never disclosed publicly, and were never in use.

Cuno restarted its membrane program in 1978 after seeing a Pall sample.

## II. The Pall Patent

### A. The Invention and Patent Application.

Turning to the Pall patent, even before Marinaccio's experiments, Dr. Pall was conducting research on microporous filters made from polymeric materials, including nylon, in the mid- to late-1960's. He set aside that project in 1969 because he believed developments in other areas were more promising. In mid-1974, Dr. Pall reactivated his research program in microporous polymeric membranes. By November, 1974, he made a promising microporous membrane from Nylon 11 and Nylon 612. It's clear to this Court that in 1975 Dr. Pall tried to design around the Marinaccio patent, just as MSI later tried to

design around the Pall patent. Indeed, Pall focused heavy resources on designing around the Marinaccio patent. Unlike MSI, however, Dr. Pall did it successfully. By September 1975 he made a pliant, alcohol-insoluble, skinless microporous membrane from Nylon 66. By November 1975 he had repeated this result on a larger scale.

The cases make clear that a patent applicant can be his own lexicographer.[2] Dr. Pall's patent application reveals that Dr. Pall considered the membrane that he had developed to be naturally hydrophilic, but it is important to remember what Dr. Pall means when he uses the word hydrophilic. Use of the word hydrophilic in the mechanical sciences and in chemistry differs from Dr. Pall's use of the word. In those industries, a material is thought to be hydrophilic if the contact angle of a drop of water with the surface of the material is less than 90 degrees, and hydrophobic if the contact angle of the drop of water with the surface of the material is greater than 90 degrees. The qualities of hydrophilicity – attractiveness to water, and hydrophobicity – repelling water, are confirmed by a variety of formulae and tests involving capillary action of the material and water.

A substance is naturally hydrophilic if it is attractive to water without the addition of wetting agents. It is very important to a microporous membrane that it be naturally hydrophilic – the more hydrophilic the better. This is so

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[2] *See, e.g., ZMI Corp.* v. *Cardiac Resuscitator Corp.*, 844 F.2d 1576, 1580 (Fed. Cir. 1988); *W.L. Gore & Assoc., Inc.* v. *Garlock, Inc.*, 721 F.2d 1540, 1558 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984); *Fromson* v. *Advance Offset Plate, Inc.*, 720 F.2d 1565, 1569 (Fed. Cir. 1983).

because otherwise the wetting agents themselves may interact with the material being passed through the membrane and make the membrane not commercially usable. The more hydrophilic a material is, the better it is for microporous membrane filtration in view of the need, of course, to pass the water through the material filtering out whatever is sought to be filtered out.

Dr. Pall's use of the term hydrophilic is quite different. Dr. Pall considers a material naturally hydrophilic only if it is so readily wetted with water that no contact angle at all can be measured between the material and the drop of water because the water has gone into the material in less than one second. One can understand that definition, but confusion results because he defines everything else as hydrophobic, whereas in fact certain nylon blocks, pellets, solid materials, and, most important as we will see further on, Nylon 46, in their natural states have contact angles of less than 90 degrees.

The term skinlessness should also be examined. It is clear that Pall makes no claim to skinned membranes in this patent. Figure 8 in the patent-in-suit shows a skinned membrane, which is outside the claims of the patent. Dr. Pall emphasizes that the membranes produced through the Pall patent are skinless. Skinlessness is never specifically defined in the Pall patent but clearly it is a significant parameter and it is discussed at some length, as follows, reading from Column 9 of the patent:

> The conditions under which the polyamide resin is precipitated determine the skinless nature of the membrane, as well as its physical characteristics, i.e., the size, length and shape of the through pores of the membrane. Under

certain conditions a membrane is formed which has through pores extending from surface to surface that are substantially uniform in shape and size. Under other conditions, the through pores are tapered, being wider at one surface and narrowing towards the other surface of the membrane.

Under conditions outside the scope of the invention, still another form of the membrane is obtained, having a dense skin penetrated by pores of smaller diameter than the pores in the remainder of the sheet. This skin is normally on one side of the membrane sheet, but it can be on both sides of the membrane sheet. Such skinned membranes are conventional in the art, exhibit relatively higher pressure drop and other poor filtration characteristics, and are undesirable.

Ex. 500.

Column 26 of the Pall patent, starting at Line 33, explains:

Skinned membranes behave very differently; when water wetted and their air flow-pressure drop relationship is determined, the [KL] curve is not flat initially, but slopes upward, indicating presence of large pores; transition to a more nearly vertical line is slow, with a large radius, and in the "vertical" area, instead of the sharp rise of FIG. 3 [in the patent], a sloping line is obtained, reflecting a wide pore size range. Such membranes are poorly suited to obtain sterile filtrates when challenged by bacteria; either a nonsterile fluid is obtained, or if sterility is gotten, it is at the cost of very high pressure drop to achieve a low throughput rate.

Ex. 500.

Stated another way, the skinlessness of the membranes was important for filtration applications because it assured a good flow rate and acceptable pressure drops and avoided functional imperfections typically associated with skinned membranes which rendered such membranes unsuitable for use in critical filtration applications where absolute removal of all particles larger than a predetermined size must be assured. Skinlessness is also an important attribute of nylon membranes used in biotechnological applications.

Dr. Pall found the immediate zero contact angle aspect of the nylon membranes produced by the process which he had invented unexpected since he considered the source material, that is, the pellet form of the starting nylon resins, each to have a contact angle much greater than zero. This immediate natural zero contact angle occurring within one second, which Dr. Pall defines in his patent as natural hydrophilicity, was a tremendous advantage over most known commercial filtration materials which had to be treated with a surfactant to make them hydrophilic. Such surfactants invariably contaminate the filtered fluids when they shed off to one degree or another.

A pliancy of the material produced by the Pall process likewise was important to facilitate handling, including pleating into high surface area cartridges.

The alcohol-insolubility of the membrane produced by the Pall process is important to permit the use of nylon membranes with a wide variety of liquids.

Between 1976 and 1977 Dr. Pall developed a manufacturing process for making commercial quantities of

nylon membrane. On May 15, 1978, Dr. Pall filed a parent patent application covering the products and the process for making the nylon membrane. The parent application was drafted broadly enough to encompass all alcohol-insoluble nylons which produced hydrophilic, that is, as Dr. Pall defines it, skinless microporous membranes.

At the same time, Dr. Pall prepared and filed a related application which ultimately matured into United States Patent 4,340,480, not at issue herein, directed to the range of nylon which he considered useful for making liquophilic membranes, that is, those which, though not wettable by water, were wettable by certain organic liquids.

The examiner – and the principal examiner throughout was one Frank A. Spear, Jr. – initially, on February 5, 1979, took the position that the initial application Claims 1 through 97 were all subject to certain restrictions which he listed. Ex. 545 at 112-13. In response to his direction that the claims be restricted, on March 5, 1979, a document entitled "Amendment" was filed seeking reconsideration of the requirement for a restriction in which Pall claimed,

> [t]he claims of Groups I, II and III are drawn to one indivisible invention based on the process' which is defined in Claims 1 to 31, 56 to 66, 96 and 97. As a result of this process it has been found possible to prepare a *skinless, hydrophilic alcohol-insoluble* polyamide membrane, which itself is new and patentable, because it was never before made available, and indeed no process was known for preparing it.

Ex. 545 at 114 (emphasis in original). The patent applicant wanted to emphasize that what had been invented here was this skinless, hydrophilic, alcohol-insoluble polyamide membrane.

Nevertheless, in an action mailed in June, 1979, Claims 1 through 86 and 96 and 97 were rejected by the patent examiner, Claims 87 through 95 having been withdrawn. Ex. 545 at 120. The ground of the rejection is significant. The examiner took issue with the use of the word "hydrophilic" in the original application, "because it has no absolute meaning. It is a relative term." Ex. 545 at 121. In this the examiner was precisely correct and, indeed, focused on the point that Dr. Pall, as a patent applicant, was defining hydrophilic in a manner somewhat different than the term had heretofore generally been understood. Other claims were rejected because the use of the support for the membrane had already been revealed in the prior art, including the Marinaccio patent. Ex. 545 at 121. Claims 3 and 4 were rejected as unpatentable over Marinaccio with respect to the manner in which Marinaccio had filtered the casting dope. Ex. 545 at 121. Claims 56 through 66 were rejected as unpatentable over Marinaccio and others on the ground that it was obvious to use multiple layers in a membrane and that had been shown in Marinaccio as modified by other patents. Ex. 545 at 121. Claims 75 through 86 were rejected on the ground that "[i]t would be obvious to use a solution ready to precipitate in Marinaccio," and reference is made to other patents. Ex. 545 at 122.

That did not slow down Dr. Pall. In response to the action of June 4, 1979, Pall stated in a document entitled "Amendment" that "[t]he applicant agrees that the term

'hydrophilic' is perhaps susceptible of being misunderstood, because it is not precise." Ex. 545 at 129. He then goes on to explain exactly what he means:

> A very high angle of contact indicates very poor wetting, while a zero angle of contact defines complete or perfect wetting. While the polyamide resins from which the membranes of this invention are made have a high angle of contact and are not wetted by water, the membranes of the invention have a substantially zero contact angle, because they are readily wetted by water.

Ex. 545 at 129. Dr. Pall then amended Claim 27 accordingly.

All claims, including the claims objected to by the examiner, which use the term hydrophilic were then further amended so as to indicate either that the membrane has a substantially zero angle of contact with water or that the membrane is readily wetted by water. This defines hydrophilicity in a precise way and also distinguishes the applicant's membranes from the membranes of the prior art. The fact is that the polyamide resins from which the membranes of this invention are made have a high angle of contact with water and are not wetted by water.

At this stage in the application process, Dr. Pall then addressed the examiner's concern as to whether particular types of nylons are critical elements of the process, stating:

> However, there is nothing critical in the polyamide resin, apart from its being alcohol-insoluble. The applicant believes that the invention is applicable to any alcohol-insoluble polyamide

> resin, and has said so, not only in the broad claims but also in the broad statements of the invention at pages 15 to 21. Throughout this portion of the specification, the term "polyamide resin" is used generically to encompass the entire class of alcohol-insoluble hydrophobic polyamide resins.

Ex. 545 at 130. The word hydrophobic is used in this passage, the Court infers, in a manner directly the opposite of the Pall definition of hydrophilic.

Dr. Pall further stated: "This being so, and there being no prior art requiring a narrowing of the claims in this respect, the applicant proposes to maintain the present scope of 'polyamide' in the claims." Ex. 545 at 131.

On December 3, 1979, the examiner rejected all the claims in greater detail. Ex. 545 at 165. At that time, the examiner rejected one of the key elements of Dr. Pall's claimed invention, controlled nucleation. The examiner stated:

> It is submitted that there is some nucleation in Marinaccio et al. For instance, during the addition of small amounts of non solvent, there would come a time when a small amount of precipitate would form temporarily and immediately redissolve. In fact, applicant's specification (pages 43-44) suggests that there is some nucleation in Marinaccio et al.

Ex. 545 at 166. The examiner stated that it would be obvious to use the support of Brown and others in Marinaccio – by support the Court infers that the examiner is referring to the polyester support for the membrane sheet. The examiner continued to believe that it would be

obvious to filter the casting dope and doing so was not an advance over Marinaccio et al. Use of multiple layers would also be obvious and was not an advance over Marinaccio et al. The examiner made reference to a Sharp membrane as being hydrophilic in the sense that they have produced membranes, and so has Marinaccio, which are "more readily wettable than prior art films." Ex. 545 at 167. The examiner stated that one would obviously expect a very thin, very porous film to be completely wettable throughout as claimed. The examiner did not think there was very much to Dr. Pall's invention, at least at this time. The rejection for multilayers was maintained. Significantly, the examiner again rejected the application, saying it would be obvious to use a solution ready to precipitate in Marinaccio as shown by Lovell, and to filter it as shown by Jamison.

That rejection did not deter Dr. Pall and his people, either. The summary record of the examiner interview on May 2, 1980 indicates that all claims were discussed and Marinaccio, Brown, and Sharp were identified as prior art. Ex. 545 at 172. The examiner noted that he had received an "impressive demonstration." Ex. 545 at 172. He further noted, "examiner will consider 132 declarations in detail while reflecting on the demonstration. Check examples for support of 6-10 carbon atoms." Then the examiner remarked, "Markush looks promising." Ex. 545 at 172. A Markush claim is a claim which claims a group of related things of which examples are given.

It is likely that a new approach to defining what was claimed was also discussed at this interview because the claim was amended in a document entitled "Amendment" dated May 5, 1980, three days after that interview.

Claim 1, describing the invention, was to be amended as follows:

> A process for preparing skinless, hydrophilic, alcohol-insoluble polyamide membranes that are readily wetted by water which comprises preparing a solution of an alcohol-insoluble polyamide resin, *selected from the group consisting of polyhexamethylene adipamide, polyhexamethylene sebacate and poly-e-caprolactam* in a polyamide *resin* solvent, inducing nucleation of the solution by controlled addition to the solution of a non-solvent for the polyamide resin. . . .

Ex. 545 at 175 (emphasis in original). The rest of the claims were also to be amended to incorporate the limitations imposed by the amendment to Claim 1. In the remarks section of the amendment, it is stated that:

> As indicated at the interview, Claims 1, 32, 56, 67, and 75, although not rejected on the grounds of undue breadth, are amended because, on the basis of research done since this application was filed, the applicant now considers that the process described and claimed herein is actually applicable only to polyamide resins which are polymers of hexamethylene diamine and aliphatic saturated dicarboxylic acids having from six to ten carbon atoms. As indicated at Page 22, Lines 12 to 14, the preferred polyamide resins now recited in these claims in a Markush group are polyhexamethylene adipamide (Nylon 66), poly-e-caprolactam (Nylon 6), and polyhexamethylene sebacamide (Nylon 610). These embrace the limits of the class of saturated

> aliphatic dicarboxylic acids having from six (adipic) to ten (sebacic) carbon atoms.

Ex. 545 at 178.

With reference to nucleation in the Marinaccio patent, the applicant stated:

> [Claims 75 to 86] are directed to a casting resin solution for forming hydrophilic skinless microporous polyamide membranes that have a visible precipitate of polyamide resin formed during the addition of the nonsolvent, and that is nucleated by virtue of the addition of the nonsolvent under controlled conditions of solvent, of nonsolvent, and of resin concentration, temperature, mixing intensity, addition time, and system geometry, resulting in this visible precipitate. This rejection is accordingly answered by the discussion above of the phenomenon of nucleation vis-a-vis the disclosure of the Marinaccio et al. patent, in connection with the rejection of Claim 1 on Marinaccio et al. The Marinaccio et al. disclosure clearly teaches one *not* to use a solution which contains a visible precipitate. Dilution with nonsolvent cannot proceed this far, but only up to the point of incipient precipitation of the nylon. This is before a visible precipitate is formed, not after. Note Column 6, Lines 6 to 9 of the reference. Thus, to use a solution that contains a visible precipitate is to proceed contrary to the Marinaccio et al. disclosure, as noted above.

Ex. 545 at 213 (emphasis in original).

On October 20, 1980, a continuation-in-part was filed which discusses the full abstract of the disclosure. Ex. 544. The continuation-in-part redefines the invention by

what has been referred to in this litigation "the ratio claims":

> The application Serial No. 905,698 has been refiled to provide basis for a narrow subclass of polyamide resins disclosed in Serial No. 905,698 that form such skinless hydrophilic membranes. All members of this class have a ratio $CH_2$:NHCO of methylene $CH_2$ to amide NHCO groups within the range from about 5:1 to about 7:1, including polyhexamethylene adipamide (Nylon 66), poly-e-caprolacatam (Nylon 6), polyhexamethylene sebacamide (Nylon 610), poly-7-aminoheptanoamide (Nylon 7), polyhexamethylene azeleamide (Nylon 69), and mixtures of two or more thereof, as well as mixtures thereof with higher polyamide homologues such as polyhexamethylene dodecandiamide (Nylon 612) in portions such that the mixture has an average of $CH_2$:NHCO ratio within the stated range. The first three polyamides, Nylon 66, Nylon 6 and Nylon 610, are preferred.
>
> The other polyamides disclosed in Serial No. 905,698 have been found *not* to form hydrophilic skinless membranes. Some of them, those that have a ratio $CH_2$:NHCO of methylene $CH_2$ to amide NHCO groups within the range from about 7:1 to about 12:1, form skinless *liquophilic* membranes. The others form *hydrophobic* skinned membranes.

Ex. 544 at 123 (emphasis in original).

On August 24, 1981, the examiner allowed Claims 1 through 76, and 111 through 115 and rejected Claims 77 through 110 and 116 through 172. He made the following note: "The broadly recited amide having the claimed ratio

of $CH_2$ to NHCO groups is unwarranted in view of the disclosure. The various mixtures in that range are particularly unsupported. Only one mixture appears in the examples. (Ex. 68). Most of the examples involve only Nylon 66." Ex. 544 at 168. In the summary record of the examiner interview, the examiner wrote that all the rejected claims were discussed, that there was no rejection based on prior art, and that the amendment looks promising. Ex. 544 at 170. He wrote that three options were discussed, all of which would clear up Claim 87. The amendment to which reference is made by the examiner is that which follows on page 172 of Exhibit 544. The most significant language therein is contained in the remarks section and it reads:

> The range of $CH_2$:NHCO ratios within the range from about 5:1 to about 7:1 is actually rather narrow, and it is moreover well supported in the disclosure. The ratio of 5:1 requires there to be five $CH_2$ to one NHCO group, and the ratio of 7:1 requires there be seven $CH_2$ groups to one NHCO group. These limits constrain a rather narrow range of $CH_2$:NHCO ratios, and clearly exclude the vast majority of polyamide resins, all of which can of course be prepared from diamines and dicarboxylic acids or aminocarboxylic acids having virtually infinite number of carbon atoms, in virtually infinite permutations.
>
> The specification at the bottom of page 22 lists a number of commercially available polyamide resins that fall within the limits of the ratio range, and these are as follows:

| | | |
|---|---|---|
| Nylon 6 | $[(CH_2)_5CONH]_n$ | 5:1 |
| Nylon 66 | $[(CH_2)_6NHCO(CH_2)_4CONH]_n$ | 5:1 |
| Nylon 610 | $[(CH_2)_6NHCO(CH_3)_8CONH]_n$ | 7:1 |
| Nylon 7 | $[(CH_2)_5CONH]_n$ | 6:1 |
| Nylon 69 | $[(CH_2)_6NHCO(CH_2)_7CONH]_n$ | 6.5:1 |

> Mixtures of these with each other or with polyamides outside the range but with an average ratio within the limits as well as other polyamides within the range can of course be conceived, but the above should make it clear that those listed are virtually all of the permutations based on hexamethylene diamine, or on aminocarboxylic acids, of which only Nylon 8 $[(CH_2)_6CONH]_n$ is not specified.

Ex. 544 at 173-74.

The Pall patent issued on July 20, 1982. Although Nylon 6 is included within the patent claims of the Pall patent, Pall does not manufacture anything commercially using Nylon 6.

B. The Advance Over the Prior Art.

Dr. Pall invented the first naturally and instantaneously wettable, completely skinless, and alcohol-insoluble polymeric membrane and a process for making it. The membrane was suitable for service in severe solvent environments and for sterile filtration. It was strong and pleatable so that without plasticizers it could be made into a cartridge. It met all of the criteria the industry had long sought. And remarkably, it was made of

nylon, a material that had been investigated several times before without success.

The process invented by Dr. Pall to prepare the membrane, and described in his patent, involved the preparation of a precisely nucleated casting solution made up of solvent, nonsolvent, and nylon, casting that solution into a film and quenching the film in a bath containing solvent and nonsolvent. While those skilled in the art had known how to prepare membranes by casting solutions of polymers, the step of precisely controlling the nucleation of the solution prior to casting, thereby achieving certain properties such as particular pore sizes, or skinlessness, was altogether new and represented a breakthrough in the art.

Dr. Pall was the first to recognize the connection between true skinlessness, pore size distribution, and the titre reduction of bacteria passage. This is now recognized to be one of the main advantages of skinlessness in microfiltration membranes. Prior to Dr. Pall's invention, a titre reduction of 7 was the standard, and few besides Dr. Pall strove to increase the titre reduction. Millipore, for example, spoke in terms of such erroneous concepts as absolute retention and pore sizes of .22 microns.

Clearly the understanding of microfiltration at that time was vastly less sophisticated than it is now. The efforts of Dr. Pall and his colleagues were of great importance to the theoretical aspects of microfiltration and helped move microfiltration from an art to a science. Dr. Pall's papers described the first studies which addressed the theory of microfiltration in a thoroughly scientific and

at the same time practical manner. Dr. Pall and his associates were pioneers both in the invention, development, and commercialization of functional nylon microfiltration membranes and in the theory of microfiltration. Such practices as the determination of the KL curve as an integrity test rather than the bubble point were introduced by Dr. Pall.

To a person of ordinary skill in the art, setting out in 1974 to develop a new polymeric membrane free of all the then-existing disadvantages, there was little guidance as to what polymers and what methods for membrane formation should be pursued. A great number of polymers and casting methods had been tried without success. Such a person faced initially two broad choices. One was to improve the properties of the conventional membrane polymers especially those of the cellulosics and mixed cellulosics. This approach was a good one in that the materials were already accepted by the market place and the processing characteristics of these materials was well understood.

The other general approach was to look to polymers other than cellulosics which had intrinsic properties superior to those of the cellulosics. It was a reasonable assumption – but by no means a certainty – that superior bulk polymer properties could be transferred at least in part to the high porosity, high surface area bodies which constitute microfiltration membranes.

A worker skilled in the field in 1974 could not have predicted what processing steps would be required to achieve the Pall membrane, or even how the various required processing steps would affect the starting material.

The controlled nucleation in the Pall process is critically important to the pore size and pore size distribution of the resultant membranes. The composition of the gel bath will determine the rate of gelation and the presence or absence of skinning which in turn can influence wettability as much as the intrinsic polarity of the nylon material itself.

In the Pall process, the rate of nucleation and of crystallite growth is precisely regulated. The end effect is to provide for sufficient surface area and hence non-polymer-to-polymer-hydrogen-bonded amorphous amide (CONH) groups which are free to hydrogen-bond with water molecules and hence render the membrane instantaneously wettable. The restraint of the membrane during drying ensures that the pores remain open and that the concentration of non-polymer-to-polymer-hydrogen-bonded to amorphous amide groups remains high enough to ensure spontaneous wetting.

Nylon was not considered as a candidate by most membranologists in the mid 1970's for a number of reasons. Nylon 66 was known to be very sensitive to oxidation by, for example, sodium hypochlorite (chlorine) solutions. Since most membranologists entered the microfiltration membrane field via reversion osmosis where chlorine resistance was an important desideratum, it tended to be dismissed out of hand. The fact that chlorine was not typically encountered in microfiltration was not considered. Nylon 66 was known to be somewhat polar, but many indices suggested that it was less so than the

cellulosics which did yield spontaneously wettable membranes without surfactants. There was little understanding of how to control the dope formulating, casting, and quenching processes for nylon membranes.

Marinaccio, of course, was one of the individuals who appreciated at least in part the potentiality of nylon as an adequate microporous membrane polymer. Marinaccio's patent was known after 1975 and it was also known there was no corresponding commercial microfiltration product. The industry therefore concluded that Nylon 6, the Marinaccio preferred embodiment, was, for some unknown reason, not an adequate membrane polymer.

The very poor quality of the Marinaccio disclosure and the inclusion therein of polystyrene, a substance which may have led him down the right track but for which no membrane could possibly ultimately be constructed, suggested that the Marinaccio patent was simply a closeout of a failed product.

Likewise, the use of formic acid as the casting solvent was original. Formic acid is not a pleasant casting solvent. It has a highly acrid odor and is corrosive. It also leads to scarring of skin tissue and, therefore, must be handled carefully. At that time, more innocuous solvents such as acetone were employed. There was no way a worker in the field in 1974 or later could have predicted the properties of the final membrane product, particularly its natural and instantaneous wettability and the absence of any skinning.

Hydrophilicity, defined by the Pall patent as the complete and very rapid penetration of water through the

entire thickness of the membrane, is a property of great importance to the membrane user because the membrane filtration system must be subjected to an integrity test, either a KL or bubble point test, prior to filtration to guarantee the sterility of the filtrate. The presence of even a single small unwetted portion of the membrane will permit the flow of air through this domain, and lower the apparent KL curve or bubble point of the membrane element. Thus a membrane with an actual bubble point of 50 psi, which would suffice for sterile filtration, may only exhibit a value of 30 psi, which is inadequate for sterile filtration. The user would have no choice but to disassemble his filtration system and replace the membranes or membrane cartridge. This would have adverse economic consequences to the user – labor, cartridge replacement, cost, and to the membrane producer – loss of credibility. Therefore, instantaneous and complete membrane wettability is a practical product property necessity. It is also essential that wettability be a permanent property which will not change with the storage time at ambient conditions, temperature and relative humidity within the range normally encountered during storage and transport.

It was not possible in 1978, or even in 1989 for that matter, to predict wettability of a nylon microfiltration membrane of a given pore size from its intrinsic properties. Any prediction of complete wettability within one second or two seconds through the entire thickness of a porous membrane is impossible by extrapolation from the bulk properties of nylon polymers.

The presence of skinning on microfiltration membrane greatly reduces the concentration of accessible

surface area and hence the concentration of accessible CONH groups. This in turn retards spontaneous and instant wettability.

The microporous filtration industry reacted very favorably to the claims of the Pall patent and its commercial application since wettability with no surfactants was an extraordinarily desirable result. Scientists in the area, however, continued to express doubt that Nylon 66 could be used to form a sufficiently hydrophilic membrane to be spontaneously wettable in the membrane form without a surfactant. This is an example of the advance of the Pall patent over the prior art.

The nylon membranes covered by the Pall patent have numerous applications, primarily in filtration and as immobilization media in biotechnological applications. To date, Pall alone has sold about $400 million worth of its nylon membrane products in the aggregate.

## III. The Validity of the Pall Patent

### A. Standard of Proof.

Of course, it is unquestioned that in accordance with 35 U.S.C. § 282 the Pall patent is presumed valid. *Roper Corp.* v. *Litton Sys., Inc.*, 757 F.2d 1266, 1270 (Fed. Cir. 1985). MSI has the burden of proving all of its allegations of invalidity and unenforceability by clear and convincing evidence. *American Hoist & Derrick Co.* v. *Sowa & Sons, Inc.*, 725 F.2d 1350, 1358-60 (Fed. Cir.), *cert. denied*, 469 U.S. 821 (1984). The Federal Circuit defines clear and convincing evidence as "an abiding conviction that the truth of [the] factual contentions are 'highly probable.' "

Buildex, Inc. v. Kason Indus., Inc. 849 F.2d 1461, 1463 (Fed. Cir. 1988) (quoting *Colorado* v. *New Mexico*, 467 U.S. 310, 316 [1984]) (alteration in original).[3]

Here, to the extent MSI relies upon prior art that has previously been considered by the patent office during the prosecution of the patent application, MSI's burden of proving invalidity is especially heavy. *Polaroid Corp.* v. *Eastman Kodak Co.*, 789 F.2d 1556, 1560 (Fed. Cir.), *cert. denied*, 479 U.S. 850 (1986).

B. Anticipation by Pall's Sale of the Membrane Product.

In 1978, at a time following the initial filing of its patent application but prior to the filing of its continuation-in-part, Pall sold its membrane product commercially. It is claimed that this commercial sale of the membrane product produced by the process for which Pall later was issued a patent is an anticipation violative

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[3] On the comparison between proof by clear and convincing evidence and proof by a fair preponderance of the evidence, *see Barry Wright Corp.* v. *ITT Grinnell Corp.*, 724 F.2d 227, 233 (1st Cir. 1983) (clear and convincing requires showing that it's highly probably true); *Bose Corp.* v. *Consumers Union of United States, Inc.*, 692 F.2d 189, 195 (1st Cir. 1982) (clear and convincing means more than a preponderance, but less than a reasonable doubt), *aff'd*, 466 U.S. 485 (1984). *But see New England Elec. Sys.* v. *Securities & Exchange Comm'n*, 376 F.2d 107, 112 n.3 (1st Cir. 1967) ("all courts that we know of consistently recognize what to us seems self-apparent, that there is a significant difference" between the standards of clear and convincing evidence and fair preponderance of the evidence), *rev'd on other grounds*, 390 U.S. 207 (1968).

of Section 102(b) in that the ratio claims of the patent added in the continuation-in-part are not entitled to the filing date of the parent application and, therefore, are invalid under Section 102(b) due to Pall's earlier sales of nylon membranes.

MSI, to support that conclusion, must prove by clear and convincing evidence that the ratio claims are not entitled to the filing date of the parent application. *Ralston Purina Co.* v. *Far-Mar-Co., Inc.*, 772 F.2d 1570, 1573-74 (Fed. Cir. 1985); *Pennwalt Corp.* v. *Akzona, Inc.*, 740 F.2d 1573, 1578 (Fed. Cir. 1984). The ratio claims are entitled to the filing date of the parent application under 35 U.S.C. § 120 if the disclosure of the parent application complies with the enablement description and best mode requirements of Section 112. *DeGeorge* v. *Bernier*, 768 F.2d 1318, 1320 n.1 (Fed. Cir. 1985); *Pennwalt Corp.*, 740 F.2d at 1577, 1580 n.13; *Hughes Aircraft Co.* v. *United States*, 717 F.2d 1351, 1358-59 (Fed. Cir. 1983). Compliance with the best mode enablement requirement is not contested in this case. The enablement description requirement is met if the disclosure of the parent application would have reasonably conveyed to an artisan of ordinary skill that Dr. Pall had invented the subject matter of the ratio claims when he filed the patent. *Utter* v. *Hiraga*, 845 F.2d 993, 999 (Fed. Cir. 1988); *Application of Smith*, 481 F.2d 910, 914 (Cust. & Pat. App. 1973). The methylene to amide ratio was well-recognized as an inherent property of nylons at the time of the original application in 1978. Accordingly, the Court finds that the methylene to amide ratio was impliedly disclosed in the parent application and the addition of the express language in the continuation-in-part application did not constitute new matter.

Since the ratio claims recite an inherent property of the group of nylons disclosed and claimed in the parent application for use in membrane manufacture, the enablement description requirement is satisfied. *Kennecott Corp.* v. *Kyocera Int'l, Inc.*, 835 F.2d 1419, 1421-23 (Fed. Cir. 1987), *cert. denied*, 486 U.S. 1008 (1988).

Accordingly, MSI has failed to prove by clear and convincing evidence that the ratio claims are not entitled to the filing date of the parent application, and since the filing date of the parent application is prior to the allegedly invalidating sales of membranes, the assertion of invalidity under section 102(b) fails.

C. Anticipation of the Pall Patent by Marinaccio.

The Court addressed in Part I, *supra*, the disclosure under 102(g) of Marinaccio's prior invention. Now the Court will address the anticipation of the Pall patent by Marinaccio.

In order for a prior art reference to anticipate a claim of the Pall patent, two conditions must be met. First, all of the elements of that claim must be found either expressly or inherently in that single reference. *Akzo N.V.* v. *United States Int'l Trade Comm'n*, 808 F.2d 1471, 1479 (Fed. Cir. 1986), *cert. denied*, 482 U.S. 909, 96 L. Ed. 2d 382, 107 S. Ct. 2490 (1987); *Tyler Refrigeration* v. *Kysor Indus. Corp.*, 777 F.2d 687, 689 (Fed. Cir. 1985); *In Re Donohue*, 766 F.2d 531, 534 (Fed. Cir. 1985); *W.L. Gore and Assocs., Inc.*, 721 F.2d at 1554. Second, that single reference must enable one skilled in the art to practice the claimed invention without undue experimentation. *Akzo*, 808 F.2d at 1479;

*Titanium Metals Corp. of America* v. *Banner*, 778 F.2d 775, 781-82 (Fed. Cir. 1985). *See Hybritech, Inc.* v. *Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379 (Fed. Cir. 1986), *cert. denied*, 480 U.S. 947 (1987). For a process to anticipate a product the process must consistently reproduce the product. *W.L. Gore and Assocs.*, 721 F.2d at 1554.

In this case, the Court finds that the Marinaccio patent, though certainly an advance, fails to disclose to one skilled in the art all of the elements of any of the claims at issue in the Pall patent. More specifically, it fails to disclose in a manner which would allow a person skilled in the art to practice the aspects of controlled nucleation, the concern over temperature, the concern over skinlessness, and the inherent wettability. Moreover, the Marinaccio patent is silent with respect to what, if anything, happens to a product made in accordance with its processes when heated to a temperature just below the softening temperature of the product. Therefore the Court rules that the Marinaccio patent is not an anticipatory reference such as to invalidate the Pall patent. *United States* v. *Adams*, 383 U.S. 39 (1966).

Likewise, the Court is not convinced that there was any public disclosure of the work that Dr. Johnson did on Nylon 66 while at Millipore, or commercial embodiment thereof, or that, in fact, was there any invention in that work which would anticipate the Pall patent.

D. Obviousness.

MSI claims that the Pall patent fails because it is obvious. The issue with respect to obviousness is whether MSI has established by clear and convincing evidence

that the differences in the asserted claims of the Pall patent over the prior art would have been obvious to a person of ordinary skill in the art when Dr. Pall made his invention embodied in those claims. 35 U.S.C. § 103. Obviousness is a question of law. It is based on factual inquiries and factual evidence. *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966); *Stevenson* v. *Int'l Trade Comm'n*, 612 F.2d 546, 549 (C.C.P.A. 1979).

The issue of obviousness requires inquiry into the following areas: the scope and content of the prior art; the differences between the prior art and the patent claims at issue; the level of ordinary skill in the art at the time the invention was made; and objective evidence that may indicate obviousness or non-obviousness. *Graham*, 383 U.S. at 17-18. *Bausch & Lomb, Inc.* v. *Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 447 (Fed. Cir. 1986), *cert. denied*, 484 U.S. 823 (1987).

The issue of obviousness is determined entirely with reference to a hypothetical person having ordinary skill in the art. *Standard Oil Co.* v. *Am. Cyanamid Co.*, 774 F.2d 448, 454 (Fed. Cir. 1985). Factors that may be considered in determining the level of ordinary skill in the pertinent art include: the educational level of the inventor; types of problems encountered in the art; prior art solutions to these problems; the rapidity with which innovations are made; the sophistication of the technology; and the educational level of active workers in the field. *Environmental Designs Ltd.* v. *Union Oil Co.*, 713 F.2d 693, 696-97 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984). A person of ordinary skill is presumed to be one who thinks along the line of conventional wisdom in the art and is not one who undertakes to innovate. *Standard Oil*, 774 F.2d at 454.

The Court has made the findings relevant on this issue above, with one exception – the objective evidence of nonobviousness. Objective evidence of nonobviousness may well be the most pertinent probative and revealing evidence available to aid in reaching a conclusion with respect to this issue. *Demaco Corp.* v. *F. Von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1391-92 (Fed. Cir.), *cert. denied*, 488 U.S. 956 (1988).

Both the Pall and the MSI product literature emphasize that the sales of nylon membranes by both of them[4] are directly attributable to the advantages offered by the invention of the Pall patent, including its natural wettability, uniform porosity, and skinlessness. Indeed, MSI considered Pall's nylon membrane to be revolutionary in the art. MSI's marketing information characterized its own Nylon 66 product as, "the first innovative product to be introduced to this market in 20 years. The nylon membrane has no extractables because of its natural wettability and is virtually indestructible." The introduction of nylon membrane permitted Pall to surpass Millipore as the leader in microfiltration membranes. The industry was surprised by Pall's introduction of a skinless nylon membrane which was naturally wettable without the presence of surfactants because others had failed to achieve such a membrane. The introduction of Pall's nylon membrane represented a major breakthrough in the filtration industry. Dr. Pall was the first person to work

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[4] MSI has some $17 million worth of such sales.

with a highly crystalline material and wind up with a reproducible membrane of uniform pore size. As recited above, AMF/Cuno had abandoned its nylon membrane project because of technical problems. Other investigators and scientists in the field, including Dr. Kesting, were surprised by Pall's introduction of nylon membrane because they had been unsuccessfully trying to obtain a membrane that was naturally wettable without the presence of surfactants for many years. Commercial success is a strong factor favoring non-obviousness. *Akzo*, 808 F.2d at 1481.

MSI has failed to prove by fair and clear and convincing evidence that any of the claims in issue in the Pall patent would have been obvious in light of the prior art.

E. Definiteness.

Claims are sufficiently definite if, when read in light of the specifications, they reasonably apprise those skilled in the art both of the utilization and scope of the invention and are as precise as the subject matter permits. *Hybritech, Inc.*, 802 F.2d at 1385. The use of the term "about" "does not impart invalidity to the claims [of a patent], but is to be considered in determination of infringement." *Andrew Corp.* v. *Gabriel Elec., Inc.*, 847 F.2d 819, 822 (Fed. Cir.), *cert. denied*, 488 U.S. 927 (1988). *See also, W.L. Gore & Assocs.*, 842 F.2d at 1280; *Hybritech, Inc.*, 802 F.2d at 1385; *but see Amgen, Inc.* v. *Chugai Pharmaceutical Co., Ltd.*, 927 F.2d 1200, 1217-18 (Fed. Cir.), *cert. denied sub nom., Genetics Institute* v. *Amgen, Inc.*, 112 S. Ct. 169 (1991).

The Court noted above that there are many cases that confirm that every patentee may be his own lexicographer. *See, e.g., Hormone Research Found.* v. *Genentech, Inc.*,

904 F.2d 1558, 1563 (Fed. Cir. 1990), *cert. dismissed*, 111 S. Ct. 1434 (1991); *Jonsson* v. *Stanley Works*, 903 F.2d 812, 821 (Fed. Cir. 1990); *W.L. Gore & Assocs.*, 721 F.2d at 1558. This means that a patentee can choose his own terms and use them as he wishes so long as he remains consistent in their use and makes their meaning reasonably clear. *Ellipse Corp.* v. *Ford Motor Co.*, 452 F.2d 163, 167 (7th Cir. 1971), *cert. denied*, 406 U.S. 948 (1972). *See also Constant* v. *Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1571 (Fed. Cir.), *cert. denied*, 488 U.S. 892 (1988) (patentee may be his own lexicographer provided that the patent specification supports his asserted definition). With respect to the challenges raised in this case, the use of the terms "about," "hydrophilic" and "skinless" do not impart invalidity to the claims of the patent but the meaning of those terms is to be considered in determining infringement.

F. Summary of Conclusions Regarding Validity.

As there was no new matter in the continuation-in-part application, the claim of fraud on the Patent Office is inappropriate and that claim fails. Likewise, the Court rules that the Pall patent is not anticipated by virtue of its own 1978 commercialization of its nylon membrane; the Marinaccio patent does not anticipate the Pall patent; the Pall patent is not obvious when tested against the AMF/Cuno nylon membrane project which was terminated with no disclosure or benefit to the public, or when tested with respect to the Millipore Nylon 66 project which likewise had no disclosure or benefit to the public; the Pall patent was not obvious in light of the prior art that was known, given the commercial success of the Pall patent, the surprise and recognition of the industry, and

the failure by others; and the Pall patent is adequately definite.

IV. Infringement

A. Nylon 66.

1. The Product Claims

The specific claims Pall alleges are infringed by MSI with respect to its manufacture and sale of microporous membrane made from Nylon 66 are set forth in Appendix A to this opinion.

a. Hydrophilicity

MSI's Nylon 66 membranes are capable when completely immersed in water of being wetted through within no more than one second.

Under the definition of hydrophilicity as that term is used in the Pall patent, MSI's Nylon 66 membranes are hydrophilic as matter of fact.

b. Skinlessness

The matter of skinlessness is a matter of significant import here. If one looks with the naked eye at the Pall membrane and the MSI membrane, they look and feel identical. In the MSI membranes, however, there is more crystallinity on the surface than in the interior. Thus, if one magnifies the cross-sectional view of a Pall membrane and an MSI membrane thousands of times by a scanning electron microscope, or similarly magnifies a top down or bottom up view of both those membranes,

they look substantially different. The Pall membrane appears of uniform porosity throughout. Under a scanning electron microscope magnification of thousands of times, however, at least one surface of the MSI membrane frequently has, when compared to the interior of that membrane, a surface where the pore size looks significantly different. Many of the MSI membranes look like they have a skin, as that word is used to refer to the epidermis of the human body, in that the membranes have a coating that appears to be of substantially less porosity than the interior.

The photographic evidence reveals that at 2,000, 5,000, and 10,000 times magnification the MSI membranes do not look like the Pall membranes. Moreover, there are voids that appear to be bubbles in the interior of the MSI membranes. Sometimes these bubbles appear on the surface of the membrane. In an MSI membrane that is supposedly rated .2 microns, voids or bubbles appear that are as big as ten microns.

Although scanning electron microscope examples of a Pall membrane are included in the Pall patent, the definition of skinlessness as used in the Pall patent is one which does not depend on visual inspection. Whether a membrane is skinless depends in part on whether the membrane has pores which are substantially uniform in size and shape. Whether the membrane is skinless further depends on whether it has the characteristics which allow the passage of water through the membrane in specific fashion as measured by the KL curve, all, in this Court's judgment, adequately defined in the patent.

Pall contends here that the actual functioning of the MSI membrane is the same as that of the Pall membrane. Pall is correct at least insofar as that functioning helps define skinlessness. The MSI membranes perform as relatively adequate skinless membranes. The Pall patent speaks of skinned membranes exhibiting relatively higher pressure drop and other poor filtration characteristics. MSI membranes lack these defective characteristics. There is no evidence that persuades this Court of any fluid-blocking layer on MSI's membranes, nor of pinholes or other defects rendering them incapable of performing as microporous membranes. Indeed, the MSI product literature indicates that MSI's membranes have uniform pore structures and are thus skinless within the meaning of the Pall patent. MSI's own descriptions of its membranes include "highly uniform membrane," "uniform pore size," "highly porous," "precise porosity," and "superior bubble point uniformity." MSI's own documents further suggest that a porous structure and a uniform pore structure indicate the absence of skinning.

These functional aspects can be explicated further. A bubble point is the pressure that has to be applied to a membrane whose pores have been filled with water in order to force the water through the largest pore. The bubble point is an indication of the largest pore present in a membrane, as that pore releases the water within it before the smaller pores do. Thus, the larger the bubble point the smaller the pores in the membrane.

MSI also employs flow time to rate its membranes. Flow time is the time required for a certain amount of water to pass through a given area of membrane. The smaller the pores in the membrane the longer or higher

the flow time. Very high flow times for particular bubble points indicate skinned membranes. The relationship between pore size, bubble point and flow time for MSI membranes is as follows:

| Pore Size | Bubble Point | Flowtime |
|---|---|---|
| 0.2 microns | 40-50 psi | 200-350 sec |
| 0.4 microns | 30 psi | about 110 sec |
| 5.0 microns | 12 psi | less than 50 sec |

The bubble points of Pall membranes made in accordance with the patent-in-suit are similar to those of the MSI membranes for similar pore sizes. MSI membranes, interestingly, have flow times that frequently are comparable and sometimes even better than skinless Pall membranes as the following data indicates.

| Type Membrane | Flowtimes in seconds for predetermined amount of water to pass through membrane | |
|---|---|---|
| | MSI[5] | Pall |
| 40-50 psi bubble point membrane | 200-350 | 190-455[6] |
| 30 psi bubble point membrane | about 110 | 46-160[7] |
| 12 psi bubble point membrane | less than 50 | 22[8] |

[5] The flowtime data for the MSI membrane was elicited from Dr. Johnson at Tr. 1996 and was recorded on Demonstrative TX-32.

[6] The Pall data is found in an MSI notebook, TX-122 at 481.

[7] The Pall data is found in an MSI notebook, TX-94 at 69.

[8] The Pall data is found in an MSI notebook, TX-122 at 462.

Moreover, the KL curves of the MSI membranes tested are similar to the KL curves of the Pall membrane. The similarity is especially great where, under constant pressure, there is an abrupt curve upward rather than a gradual curve upward. This shape of the KL curves is explained by the fact that the through pores, the pores that go from one side of the membrane to the other, are all substantially the same size.

Because of these characteristics, the Court finds that the MSI membranes are skinless. It does appear that MSI's practice of the art is less perfect than that of Pall, but an infringer cannot take refuge in the fact that he has a sloppy product. *Laitram Corp.* v. *Cambridge Wire Cloth Co.*, 863 F.2d 855, 859 (Fed. Cir. 1988), *cert. denied*, 490 U.S. 1068 (1989) ("inefficient infringement is still infringement"); *Johns Manville Corp.* v. *Guardian Indus. Corp.*, 586 F. Supp. 1034, 1066 (E.D.Mich. 1983), *aff'd*, 770 F.2d 178 (Fed. Cir. 1985) ("'imperfect infringement' is infringement nevertheless"). This sloppiness, after all, is visible only to one who has a scanning electron microscope which he can turn up to a magnification of a thousand times. The MSI product serves the same goal as the Pall product and serves it in the same way. Though there is no doubt that it looks different under extreme magnification, the MSI product is functionly skinless in the manner of the Pall product. Indeed, the MSI membrane with its surface configuration, which the Court has held is not skinned in light of the Pall patent claims, appears to work better than the Pall patent for those DNA transfers involving blotting. This is because there's more polymer at the surface to hold the DNA.

Within the Pall patent itself, the significant references to skinlessness are found in Column 2 at Lines 10 through 24. Ex. 500. It is suggested there that the skin to avoid is an "exceedingly thin but relatively dense barrier layer or 'skin' from about 0.1 to 5.0 microns thickness of a microporous polymer in which an average pore diameter is in the millimicron range, for example, from 1.0 to 1000 millimicrons, i.e., about one-tenth to one-hundredth the thickness of the skin." Admittedly, the MSI membranes have this exceedingly thin surface layer. However, the Court does not find that it is relatively dense, but rather that it is permeated by millions of tiny pores roughly the same size as the pores in the rest of the membrane.

Skinned membranes, as defined in the Pall Patent in Column 1 at Lines 49 through 53, have smaller surface pores. While the density of the surface micropores in the MSI membrane is less per micron than in the interior, the surface micropores themselves are of substantially the same diameter as the micropores in the remainder of the membrane.

Likewise, in Column 2, Lines 32 through 34 of the Pall patent, there is a reference to an abrupt transition from skin to support layer. Although there is a transition in the MSI membrane from the surface to the interior support layer, there are pores on the MSI membranes that are substantially the same size as the interior support layer and act as pores which go from one side of the membrane to the other.

The conclusion that MSI's nylon membranes are skinless is supported further by the following facts. MSI's nylon membranes compete with Pall's in many areas that

require skinless membranes, such as filtration and microfiltration and biotechnical applications. MSI advertised their product as a skinless membrane. Finally, numerous references in MSI's notebooks relating to its laboratory work on membranes indicate that MSI considered skinned membranes to have undesirable performance qualities, as exemplified as follows: "Membrane all skin. Flow 10 min.", TX-117 at 734; "Second was all skin, no flow time," TX-117 at 745; "Skinned and very weak – tears coming off of plate." TX-598 at M5420; "very fragile – skinned," TX-598, p. M5482; "doesn't rewet – too skinned," TX-KM, p. M5366. The Court finds, as fact, that MSI's membranes are skinless within the meaning of the Pall patent and its claims.

c. Alcohol insolubility

MSI's Nylon 66 membranes are alcohol-insoluble as are the resins from which they are made.

d. Hydrophobic polyamide resin

Nylon 66 has a contact angle of between 70 and 80 degrees. Nylon 46 has a contact angle of 45 degrees. Under the general definition of hydrophilicity, Nylon 46 is more hydrophilic than Nylon 66. However, under the Pall definition, which the Court has found to be sufficiently definite, both nylons are hydrophobic.

e. Methylene to amide ratio

There is no dispute that MSI originally employed Nylon 66 and presently employs Nylon 46, and for some

applications continues to employ Nylon 66 as the resins from which it makes its membranes. Nylon 66 has a methylene to amide ratio of five, Nylon 46 has a methylene to amide ratio of four.

f. Reversion to hydrophobicity when heated

Whether MSI's Nylon 66 exhibits the reversion feature which is part of the claims of the Pall patent is in dispute. This Court concludes that MSI's Nylon 66, when heated to slightly below its melting point, reverts such that thereafter at least part of the membrane surface is not capable of being wetted within one second. In that sense, MSI's Nylon 66 membrane is directly infringing. Because the chemical analysis which explains this aspect of the properties of both the Pall and the MSI Nylon 66 membrane is not well understood, the Court can make no particular scientific findings thereon. The membranes react sufficiently similarly that the Court finds that MSI infringes Pall with respect to the reversion feature. With respect to this feature, however, the behavior of the Pall and the MSI membranes is not completely congruent. The data suggest that when heated close to its melting point a Pall membrane is no longer hydrophilic as Pall defines it throughout much or all of its surface, whereas it appears the MSI membrane may remain wettable throughout part of the surface but not wettable throughout all of it. The point is a close one, but the Court rules that the MSI Nylon 66 membrane in fact infringes in this regard.

g. Particle removal rating

MSI's product literature indicates – and the Court finds – that most of the MSI membranes have absolute particle removal ratings of .1 to .20 microns. The term absolute particle removal rating as used in the patent claims is synonymous with MSI's pore size rating used in its trade literature.

h. Membrane thickness

MSI's membranes are about one-tenth of a micron to two-tenths of a micron thick and its nylon membrane product literature indicates thicknesses from 80 to 125 microns. That is .08 to .125 millimicron. MSI's membranes thus meet all the elements of Claims 48 and 132 of the Pall patent in suit.

i. The filter claims

Dealing with the filter element, it's clear from the development plan of MSI that from the very beginning MSI planned to compete with the Pall 66 cartridge, but to undercut it by price. Pall's products were considered. Competition with Pall was one of the goals of MSI from the very beginning. In light of that goal, MSI made the corporate decision to manufacture a microporous membrane from Nylon 66 that would be readily wettable. MSI's cartridge elements contain membrane formed in a tubular configuration. The tube is sealed to the end caps. One of the end caps of the filter element has an opening or a central aperture which gives access to the interior of

the filter element, and all seals are sealed tight. MSI advertises membranes to fit the Pall housing with fin and bayonet lock, and expressly makes seals that will fit the Pall housing.

MSI's product literature indicates that its filter cartridges are fluid type when it states that its cartridges are integrity tested, because only fluid-type cartridges can be integrity tested with water. MSI's filter cartridges, containing nylon membrane, meet all the elements of claims 49 and 133 of the Pall patent-in-suit. MSI's filter elements, the cartridges, contain corrugated nylon membrane sheets. Filter elements containing corrugated nylon membranes are important to the filtration industry because they permit increased amounts of membrane to be enclosed in the cartridge. MSI's filter elements, containing nylon membrane, meet all the elements of Claims 50 and 134 of the Pall patent. The end caps in MSI's filter elements are made from the polyester, polybutylene terephtalate, also known as polybutylene glycol terephtalate, or PBT. MSI first started using PBT end caps in 1983 or early 1984. The MSI filter elements, containing nylon membrane, including the end caps, are hydrophilic, as that term is used in the Pall patent, and rapidly wetted by water, and are, therefore, integrity testable. MSI's filter elements, containing nylon membrane, meet all the elements of claims 55 and 56, and 139 and 140.

2. The Process Claims

Turning to the process claims, the Court finds that the MSI process is in various respects different from that set out in the Pall patent, even recognizing that the Pall

patent does not describe a commercial process but rather, in patent terms, describes the claims to a process. It is necessary, therefore, to describe the process as used by MSI, so that a comparison can be made to the Pall process claims.

MSI's process involves, first, adding water and then adding powdered citric acid in a tank and mixing it, and then pouring off a bucket of this material into a mixer. Then certain carefully premeasured amounts of water, hydrochloric acid, and Nylon 66 pellets or powder are added and the resultant solution is mixed five hours or more and held overnight. Zytel 101, the commercial source of Nylon 66 as used by MSI, is hydrophobic, as that term is used in the Pall patent. That is, it does not have a zero contact angle; it's not readily wettable by water in approximately a second. The resultant mixture, which may be called a lacquer, is then poured into a lacquer holding tank which is movable and which can be held from zero to 24 hours until needed.

More specifically, the formulation of the lacquer contains a mixture of solvents and a nonsolvent at a ratio of nylon - 12 percent, hydrochloric acid - 8 percent, citric acid - 60 percent, and water - 20 percent. The solvent action of the hydrochloric acid is boosted by the citric acid. During a portion of the period in which it has been in production, MSI has employed formic acid as the solvent for certain applications. Formic acid is the solvent preferred in the Pall patent. Water is the nonsolvent in the casting resin. In comparison, the Pall patent examples employ 13 percent nylon in a solvent of between 66 and 71 percent formic acid and between 16 and 21 percent nonsolvent water.

The lacquer holding tank is then pumped at 4 ounces per minute through a heater tube, one half-inch in diameter by four feet, and it passes then through a clear plastic pipe through a 75 micron filter[9] and then into a static mixer. The lacquer is then delivered onto the support web, which is rolled off a roll through a coating mechanism, referred to as a knife box, into a nonsolvent immersion bath, then into a water rinse and, finally, at a rate of two to four feet per minute, into a drier where it's exposed to drying at 350 degrees Fahrenheit of hot air. The finished filter is then wrapped onto a spool.

The Court finds that MSI nucleates its nylon lacquer solution by controlling the initial mixing measurement, the concentration of the reagents, and, subsequently, the lacquer temperature and degree of agitation. Because the solvent used in the MSI formulation is hydrochloric acid, however, the lacquer does not gel anywhere near as fast as the comparable lacquer solution used by Pall. Indeed, the MSI lacquer can be maintained in commercially acceptable fashion overnight. MSI controls the mixing regimen for the initial solution by setting the mixing speed at 90 rpm. MSI has come to understand that temperature is a significant variable and the temperature of the nylon solution is initially controlled at a set temperature of 35 degrees centigrade. After mixing, the lacquer is pumped through a heat exchanger, which heats it to a particular temperature between 30 degrees and 70 degrees centigrade.

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[9] Originally the lacquer passed through a 25 micron filter, though that is no longer used.

In the MSI process, the pore size is controlled by varying the concentration of the solvent to nonsolvent components in the lacquer by minute amounts, fractions of a percent. The pore size is further controlled by heating the lacquer after it has been initially mixed and then further mixing it in a static mixer while it is being transferred to the casting box. The fact that MSI prepares membranes of different pore size by changing the temperature of the lacquer and without changing the composition indicates that the lacquer is nucleated, as that term is used in the Pall patent.

The Pall method of nucleation is one of the keys to its patent. Controlled nucleation is vital for commercial repetition of quality microporous membranes. It's equally clear that if the nucleation is done differently, the Pall patent is not infringed.

While MSI recognized the importance of the nucleation, as that term is used in the Pall patent, of its casting resin on the pore structure of a membrane as early as October, 1982, – a concept taken from the Pall patent – the appearance of a visible precipitate is *not* a significant parameter in the MSI process. It is true that independent testing of the MSI lacquer solution by Pall results in a visible precipitate temporarily appearing when drops of nonsolvent and water are added to an MSI nylon lacquer, which precipitate then redissolves in the solution. This is an indication that the solution has been properly nucleated, but that test does not indicate that there is any visible precipitate in the process as employed by MSI or any need or concern about a visible precipitate in that process. This is a crucial difference between the Pall and the MSI processes.

MSI employs filters to filter out undissolved nylon particles and other debris before spreading the casting solution on the support membrane. The MSI process cannot operate successfully without these filters.

The Pall patent examples disclose heating the casting resin solution between 35 degrees and 70 degrees centigrade, in order to control the lacquer viscosity. The MSI process depends in part on the heating of the lacquer, which is employed to control the viscosity of the resin.

After the casting solution is prepared, a distribution tube spreads the casting solution on the polyester support which is fed through a knife box to insure that a thin, even, predetermined thickness of lacquer is spread on the porous support. The Pall patent teaches that 40 to 50 percent solvent in the quench bath is necessary to slow down the reaction and temper the reaction to prevent skin formation. The MSI support, saturated with the nylon lacquer, is immersed in a nonsolvent quench bath of 40 percent citric acid and 60 percent water, where the nylon precipitates into a solid membrane. The citric acid makes the quench bath a less strong nonsolvent. It reduces the nonsolvent properties of the water and acts to temper the interaction between the lacquer film and the quench bath, thereby causing precipitation in a uniform consistent manner. The membrane is then immersed into a wash bath which removes the remaining solvent and nonsolvent. The membrane is then dried and rolled up.[10]

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[10] Additional facts explanatory of the MSI process but not bearing directly on the issue of infringement are: The viscosity of MSI's Nylon 66 resin solution is in the range of 1,000 to 3,000 centipoises. The casting and precipitating temperatures of MSI's

Since all the Pall process claims at issue depend on process claim 77 and, more specifically, since it is no part of the MSI process to seek, as is claimed by the Pall patent, "to obtain a visible precipitate of polyamide resin particles," there can be no direct infringement by MSI of the process claims of the Pall patent. That, however, does not end the analysis, because a claim may be infringed under the doctrine of equivalents if the alleged infringing product "performs substantially the same function in substantially the same way to obtain substantially the same result." *Graver Tank & Mfg. Co., Inc.* v. *Linde Air Prod. Co.*, 339 U.S. 605 (1950) (quoting *Sanitary Refrigerator Co.* v. *Winters*, 280 U.S. 30, 42 [1929]). The court determines the "equivalent" nature of the products by comparing: (1) the result obtained; (2) the means of attaining that result; and (3) the manner in which the different parts cooperate to produce the result. *Johnson & Johnson* v. *W.L. Gore & Assocs.*, 436 F. Supp. 704, 729 (D. Del. 1977) (citing *Farmhand, Inc.* v. *Craven*, 455 F.2d 609 [8th Cir. 1972]); *see also Carter-Wallace, Inc.* v. *Gillette Co.*, 531 F. Supp. 840, 873 (D. Mass. 1981), *aff'd in part, rev'd in part*, 675 F.2d 10 (1st Cir. 1982).

MSI very well knew the commercial success of the Pall patent and appreciated the substantial advance it made in the art. MSI was at all material times familiar

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process are within the range of about 10 degrees centigrade to the boiling temperature of the lowest boiling solvent or nonsolvent component present. The MSI polyester support is not stripped from the membrane before drying, and after drying remains attached to the membrane. In the MSI product, the polyester web makes up about 75 percent of the membrane thickness. It's melting point is 270 degrees centigrade.

with the Pall patent and intentionally sought to design around that patent. Designing around a patent does not constitute infringement. *See Seattle Box Co., Inc.* v. *Indus. Crating & Packing, Inc.*, 756 F.2d 1574, 1580 (Fed. Cir. 1985). The decision of the Court of Appeals for the Federal Circuit, in *Slim Fold Mfg., Inc.* v. *Kinkead Indus. Inc.*, 932 F.2d 1453 (Fed. Cir. 1991), is pertinent on this point. As Judge Rich said there:

> Intentional "designing around" the claims of a patent is not by itself a wrong which must be compensated by invocation of the doctrine of equivalents. Designing around patents is, in fact, one of the ways in which the patent system works to the advantage of the public in promoting progress in the useful arts, its constitutional purpose.

*Id.* at 1457.

Judge Rich goes on to say that "[i]t is only when the changes are so insubstantial as to result in 'a fraud on the patent' that application of the equitable doctrine of equivalents becomes desirable." *Id.* (citations omitted). Following the analysis in Slim Fold, "the first question which must be asked is 'has a substantial change been made?' Only if the answer to that question is 'no' should an accused infringer be liable for improperly trying to appropriate the claimed invention." *Id.* According to Judge Rich, this is the point at which the *Graver Tank* tripartite test should be applied:

> [T]he differences between an accused device and a claimed device are considered to be insubstantial only when the accused device performs substantially the same function *in substantially*

> *the same way* to achieve substantially the same result as the claimed device. The determination of whether an accused device meets this strict test is one of fact.

*Id.* (emphasis added) (citation omitted).

From a careful review of the MSI lab notebooks, the Court finds that MSI has set up a measurements regime that embodies the heart of the learning of the Pall patent. Due to the Pall patent, MSI could address the problem of production of microporous nylon membranes using Nylon 66 far more rapidly with less experimentation and in a much different fashion than that facing an original inventor had addressing the problems inherent in microporous membrane manufacture. By carefully measuring the components used in the process of making these nylon microporous membranes, MSI developed a process which depended more on the measurements than it did on the steps of the Pall patented process.

This Court finds that the only way one could develop such a measurements regime is through the learning of the Pall patent. The MSI casting solution performs substantially the same function in substantially the same way and obtains substantially the same overall result as to the casting solution of Pall claims 1 and 77 and the asserted claims depending thereon. The casting resin which is finally obtained and used is in all significant respects equivalent to the nucleated casting solution of the Pall patent.

The Court finds that MSI intended to design around the Pall patent. Tested by the *Graver Tank* standard, all aspects of the doctrine of equivalents are met here. The

MSI Nylon 66 process infringes by virtue of the doctrine of equivalents.

In sum, therefore, as to Nylon 66, the Pall patent stands as valid and infringed – directly infringed as to the product claims and infringed under the doctrine of equivalents as to the process claims.

B. Nylon 46.

Nylon 46 has been known to chemists and chemical engineers, at least theoretically, since 1942. The commercial manufacture of Nylon 46 commenced approximately May 1984, when Dutch State Mines revealed that it was going to introduce a new commercial polymer, Nylon 46. There are differences between Nylon 46 and Nylon 66. Nylon 66 has a melting point of 260 degrees. Nylon 46 has a melting point of 290 degrees. Indeed, Nylon 46 is more hydrophilic, as the term is generally used, than the other polymers discussed in this opinion.

By October, 1989, MSI was making a commercially acceptable microporous membrane through the use of Nylon 46. MSI uses Nylon 46 presently to make its commercial products. The original composition of Nylon 46 in its process is a Nylon 46 powder, not the pellets used by Pall. Nylon 46 has a contact angle of 45 degrees and is, therefore, under the generally-accepted chemical definition, more hydrophilic than the nylon polymers used by Pall. Nylon 46 is, however, hydrophobic as that term is used in the Pall patent. MSI developed its Nylon 46 membrane largely in response to the instant lawsuit, out of a desire to avoid the liability it expected to eventuate

from its use of Nylon 66 membrane manufacture. By MSI's own admission, there are but minor differences in MSI's process for making Nylon 46 membranes as compared to its process for making Nylon 66 membranes.

Nylon 46 is known as polytetramethylene adipamide. It is made from diaminobutane and adipic acid. It is not a polymer of hexamethylene diaminine aliphatic saturated dicarboxylic acids having from 6 to 10 carbon atoms, as required by the invention of the patent-in-suit. Instead, Nylon 46 has a ratio of methylene to amide groups of 4 to 1. It does not have a ratio of 5 to 1 or 7 to 1, as found in Nylon 66 and Nylon 610, respectively, nor does it fall anywhere within the range of 5 to 1 or 7 to 1 methylene to amide groups. Of course, the patent is not limited to 5 to 1 or 7 to 1, as to its ratio of methylene to amide groups. The patent speaks of a ratio of "about" 5 to 1 to "about" 7 to 1 methylene to amide groups.

Technical scientific exactitude in the scope of claims is not required under 35 U.S.C. § 112. *Hybritech, Inc.*, 802 F.2d at 1385. The law imposes no obligation on a patent applicant to determine what is going on in a technological gap between the claimed invention and the prior art or to set the claim limits at the precise technological edge of the invention. The claim is not fatally indefinite for failing specifically to delineate the exact point at which the claimed physical phenomenon comes into being. *Andrew Corp.*, 847 F.2d at 822-23.

Moreover, the term "about" is not an arbitrary term but is a flexible term with a meaning similar to "approximately." It is not subject to a precise and universal construction but is, instead, dependent on the facts of a

particular case. *Johnson & Johnson* v. *W. L. Gore & Assocs.*, 842 F.2d 1275, 1280 (Fed. Cir. 1988); *Amgen, Inc.*, 927 F.2d 1200 at 1218. Courts have liberally construed the word "about" in patent cases to include a range higher and lower than the specified amounts. *See Kolene Corp.* v. *Motor City Metal Treating, Inc.*, 440 F.2d 77, 82 (6th Cir.), *cert. denied*, 404 U.S. 886 (1971); *S.C. Johnson & Son, Inc.* v. *Carter-Wallace, Inc.*, 614 F. Supp. 1278, 1298, 1307-8 (S.D.N.Y. 1985). The test is whether "a person skilled in the art would read the claim of the patent to contemplate a range which includes the accused product." *Clopay Corp.* v. *Blessings Corp.*, 422 F. Supp. 1312, 1325-26 (D. Del. 1976) (citing *Johnson & Johnson* v. *W.L. Gore & Assocs., Inc.*, 377 F. Supp. 1353, 1355 [D. Del. 1974]).

A fair reading of the language used in the Pall patent is such that it strains credulity to place Nylon 46 within the range of "about" 5 to 1 to about 7 to 1. Indeed, the 4 to 1 ratio of methylene to amide groups has some chemical properties that are of marginal difference in comparison to the higher ratios. The Court finds that Nylon 46 is not logically within the range of about 5 to 1 to about 7 to 1. Nylon 46, therefore, does not literally infringe either the product or the process claims of the Pall patent. Since there is no literal infringement, here again Pall must show that the claims of the patent are entitled to the protection of the doctrine of equivalents before Nylon 46 can be held to infringe the Pall patent.

The Court finds that Nylon 46, as used by MSI, does in fact perform substantially the same function as nylons in the range of about 5 to 1 to about 7 to 1 methylene to amide groups. It performs in substantially the same way to achieve substantially the same result as the claimed

device. Indeed, MSI in its advertising doesn't even point out the source of the nylon used, and claims itself that the two nylons do precisely the same thing.

The *Graver Tank* doctrine of equivalents and its tripartite test is thus met. *Graver Tank Co.*, 339 U.S. at 605. The differences between the accused device and the claimed device are insubstantial. The answer to the question of whether a substantial change has been made by switching to Nylon 46 is "no."

The Court therefore must go on to consider whether the Nylon 46, which the Court finds infringes the Pall patent under the doctrine of equivalents, can be held so to infringe in light of file wrapper or file history estoppel. It is very clear that file wrapper estoppel bars recourse to the doctrine of equivalents in cases where the patentee attempts to secure through equivalents what has been rejected by the Patent Office. *See, e.g., Exhibit Supply Co.* v. *Ace Patents Corp.*, 315 U.S. 126 (1942); *Jonsson*, 903 F.2d at 818; *Standard Oil Co.*, 774 F.2d at 452.

"[File wrapper estoppel] prevents application of the doctrine of equivalents to recapture coverage which the patentee has surrendered by amendment whether or not prior art required the amendment." *Carter Products, Inc.* v. *Colgate-Palmolive Co.*, 269 F.2d 299, 304 (4th Cir. 1959). *See also Oregon Saw Chain Corp.* v. *McCulloch Motors Corp.*, 323 F.2d 758, 768 (9th Cir. 1963), *cert. denied*, 377 U.S. 915 (1964). Under the Fourth Circuit view, it is irrelevant whether the surrendered claim was given up in light of the prior art or some other reason. This has not been the view of all the circuits. Specifically, in *Bishman Mfg. Co.* v. *Stewart Warner Corp.*, 380 F.2d 336, 340 (7th Cir.), *cert.*

*denied*, 389 U.S. 897 (1967), the Court held that "[a] necessary condition for the establishment of a file wrapper estoppel is that the patentee must have narrowed his claim in response to an objection by the Patent Office in order to obtain the patent." Along the same lines, is the case of *Trio Process Corp.* v. *L. Goldstein's Sons, Inc.*, 461 F.2d 66 (3rd Cir.), *cert. denied*, 409 U.S. 997 (1972). There, the Court held:

> The doctrine [of file wrapper estoppel] is based on the theory that the prior art is either in the public domain or already patented, so that the patentee may not claim it as part of his invention. By redrafting or abandoning a claim in the face of a prior art rejection, the patentee is conceding that he has not invented what he thereby disclaims, and therefore will not be heard to assert, at a later date, what he disclaimed as his invention. Accordingly, for "file wrapper estoppel" to become operable, it is necessary, at the least, that a claim have been narrowed to avoid the prior art.
>
> Here, the claims were redrafted, not because they trespassed upon the prior art, but because they were considered misdescriptive in view of the specification of the patent. The rejection here was a technical matter based on the Rules of Practice of the Patent Office, and had nothing to do with the question of whether the matter rejected was patentable. In such a situation, it would not be equitable to deprive a patentee of the full fruits of his invention because of a formalistic rule of the Patent Office.

*Id.* at 75 (citations omitted). *Trio Process* is frequently cited and, as will be seen, remains good law. It has been cited

in this district, albeit for a different proposition, in *Polaroid Corp.* v. *Eastman Kodak Co.*, 641 F. Supp. 828, 853 (D. Mass. 1985), *aff'd* 789 F.2d 1556 (1st Cir.), *cert. denied*, 479 U.S. 850 (1986). *See also Johnson & Johnson* v. *W.L. Gore & Assocs.*, 436 F. Supp. 704, 730 (D. Del. 1977).

In the First Circuit, however, the law has been to the contrary. The First Circuit is aligned with the Fourth and the Ninth Circuits on this issue. The First Circuit, speaking through Chief Judge Aldrich, a most distinguished jurist and an expert in patent matters, said, in dictum, in *Borg-Warner Corp.* v. *Paragon Gear Works, Inc.*, 355 F.2d 400, 406 (1st Cir. 1965), *cert. dismissed*, 384 U.S. 935 (1966):

> In our opinion the determinative factor [as to whether file wrapper estoppel ought apply] should not be the reason why a change was required by the Patent Office, but what, in fact, was surrendered. . . . [I]t should make no difference whether [the] reason was an alleged conflict with prior art or alleged insufficient definiteness. In either event a subsequent party, examining the file to make sure that his own device . . . would not infringe, would discover that so broad a scope had been affirmatively disclaimed. The patentee, accordingly, should be estopped to recapture it.

In the usual case, this conflict between the Circuits would not be germane because this Court would be bound by the First Circuit approach. The matter at hand, however, is no longer within the jurisdiction of the First Circuit or any of the numbered circuits, but rather it is within the jurisdiction of the Federal Circuit. As a result, the conflict between Circuits could present a problem. Fortunately, the Federal Circuit has spoken to the issue in

*Bayer Aktiengesellschaft* v. *Duphar Int'l Research B.V.*, 738 F.2d 1237, 1241-43 (Fed. Cir. 1984) and earlier in *Hughes Aircraft Company Co.*, 717 F.2d at 1362.

In *Hughes*, the Federal Circuit said:

> Some Courts have expressed the view that virtually any amendment of the claims, creates a "file wrapper estoppel" effective to bar all resort to the doctrine of equivalents and to confine patentee "strictly to the letter of the limited claims granted[.]" We, as has the Supreme Court, reject that view as a wooden application of estoppel. . . .
>
> Amendment of claims is a common practice in the prosecution of a patent applications. . . . Amendments may be of different types and may serve different functions. Depending on the nature and purpose of an amendment, it may have a limiting effect within a spectrum ranging from great to small to zero.

*Hughes*, 717 F.2d at 1362-63.

Then, in *Bayer Aktiengesellschaft*, that court said:

> Thus, whenever the doctrine of file history estoppel is invoked, a close examination must be made as to, not only what was surrendered, but also the reason for such a surrender. The fact that claims were narrowed does not always mean that the doctrine of file history estoppel completely prohibits a patentee from recapturing some of what was originally claimed. Accordingly, limiting the claims because of a restriction requirement, as occurred here, would not necessarily invoke file history estoppel.

*Bayer Aktiengesellschaft*, 717 F.2d at 1243.

These decisions govern the analysis in this case, notwithstanding the earlier dispute in the Circuits and the decision of the First Circuit in *Borg-Warner*. *See also Anchor Plastics Co., Inc.* v. *Dynex Indus. Plastics Corp.*, 363 F. Supp. 582, 605 (D. N.J. 1973) (following *Borg-Warner*), *aff'd*, 492 F.2d 1238, 181 U.S.P.Q. (BNA) 611 (3d Cir.), *cert. denied*, 417 U.S. 955 (1974).

More precisely, the analysis followed by this Court here derives in part from that in *Johnson & Johnson* v. *W. L. Gore & Assocs.*, 436 F. Supp. 704 (D. Del. 1977). That case is similar to this case in that the Court there found that the claims of the patent were not literally infringed and applied the doctrine of equivalents. That court said:

> The fact that the expanded, lower density tape was unknown at the time of the application for the patent in suit does not render the doctrine of equivalents inapplicable.
>
> For infringement, the equivalent need not have been known at the time of the invention. . . . "[A]n inventor is entitled to whatever merits his invention has, even though they may be greater than he supposed."

*Id.* at 730 (quoting *Johnson & Johnson* v. *W.L. Gore & Assocs., Inc.*, 377 F. Supp. 1353, 1355 [D. Del. 1974]).

In the instant case, the evidence reveals that at the time of the Pall patent application Nylon 46 was known to people experienced as chemists in the area of nylon polymers. Its chemical properties were known. Its methylene to amide ratio was known. Even so, it was not commercially available; it was not being produced for commercial purposes. Pall, of course, did not have to

experiment with every possible methylene to amide combination in order to claim the patented invention. There was, in short, no requirement that Pall experiment with Nylon 46 to understand its properties.

This Court concludes that Pall, in limiting its claims in response to the overbreadth concerns of the patent examiner, never gave up a claim to Nylon 46. Pall's own experiments indicated the expected range of the validity of its invention, but the use of the term "about," which is an appropriate term, is indicative that Pall was not surrendering the invention down to the limits of ratios between 5 to 1 and 7 to 1 methylene to amide groups. As matter of fact, Pall never intended to abandon and did not abandon its claim to workable nylon polymers which fall outside the range of methylene to amide ratios between 5 to 1 and 7 to 1, so long as the ratio is within the penumbra of methylene to amide combinations which are "about" that range. Accordingly, the Court rules that although there is no literal infringement in this case, given its peculiar facts, the doctrine of equivalents is not trumped or rendered inapplicable by the file wrapper history.

V. Remedies

A. Injunctive Relief.

1. Scope of Injunction

Since the MSI production of microporous membrane using Nylon 66 and Nylon 46 infringes the Pall patent under the doctrine of equivalents, and since that patent is

valid, MSI, its agents, servants, and counsel, and all persons acting in concert with any of them, are forthwith enjoined from any further production or sale of any items embodying microporous membrane produced using either Nylon 66 or Nylon 46.

2. Partial Stay of Injunction

A patent holder whose patent is infringed suffers irreparable injury for every day of the infringement. Such injury cannot adequately be compensated simply by calculating the lost profits, but rather the victim of infringement suffers interference with its relationship with customers and the like, all of which the injunction is designed to prevent.

Even so, while the legal determinations here with respect to Nylon 46 are both appropriate and called for by the applicable law, they are difficult and complex and worthy of appellate review. Moreover, in the absence of a stay of so much of the injunction as pertains to Nylon 46, MSI will go out of business and, in effect, suffer corporate death.

Most important, the public interest in this calculus favors a partial stay of this injunction so that there not be an interruption in the supply to third parties who buy these materials of the various important scientific and medical applications presently served by the more economical MSI products. Balancing the harms, the harm to MSI from granting the injunction significantly outweighs the harm to Pall from partially staying the injunction.

Accordingly, the injunction as to MSI microporous membrane produced from Nylon 46, not as to MSI product using Nylon 66, is stayed pending appeal on the following terms: That an appeal bond in the sum of $ 1,700,000 is filed with the Court, which provides that it will increase by a further $ 1,700,000 on January 1, 1992, and a further $ 1,700,000 on June 30, 1992. This stay is vacated by its own terms if MSI's appeal of this Court's judgment is dismissed.

Since this is an increasing bond, there has to be another provision. The Court expects that MSI will seek an expedited hearing from the Court of Appeals of the Federal Circuit, and the increases which are to take place on January 1 and on June 30, 1992, are of no force and effect should Pall object to any advancement of the appeal, accelerated briefing schedule, or other accelerated appellate determination of the matter. Pall has to press just as hard to hang on to its judgment as MSI is pressing to have the judgment reversed. That's the only way the bond stays in effect.

B. Damages.

Chapter 35 of the United States Code, section 284, provides that, in the case of infringement, the patent owner, in this case Pall, is entitled to an award of damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the manufacture, use, and sale made of the invention by the infringer, here MSI. Pall is entitled to interest and costs as fixed by the Court. A spread sheet setting forth each of the elements of damages calculated in this case, exclusive of

interest and costs, is set forth as Appendix B to this opinion. The text sets out the Court's analysis and specific factual findings as to damages. The period of time material to the instant case includes the fiscal years set forth in the first column of the spread sheet, 1983-1990. Moreover, MSI had $ 2,786,572 in infringing sales through June 19, 1991. The total MSI infringing microporous membrane sales, including both Nylon 66 and Nylon 46, from the year 1983 through June 19, 1991, are $ 17,897,479 in the aggregate.

1. Lost Profits

Pall may recover damages for lost profits if it can show a reasonable probability that, but for the infringement, it would have made the sales that were made by MSI. *Kaufman Co., Inc.* v. *Lantech, Inc.*, 926 F.2d 1136, 1141 (Fed. Cir. 1991); *Beatrice Foods v. New England Printing*, 899 F.2d 1171, 1173 (Fed. Cir. 1990); *State Indus.* v. *Mor-Flo Indus., Inc.*, 883 F.2d 1573, 1577 (Fed. Cir. 1989), *cert. denied*, 493 U.S. 1022 (1990). To recover lost profits Pall need not negate all possibility that a purchaser might have bought a different product or might have foregone the purchase altogether. *Del Mar Avionics, Inc.* v. *Quinton Instrument, Co.*, 836 F.2d 1320, 1326 (Fed. Cir. 1987); *King Instrument Corp.* v. *Otari Corp.*, 767 F.2d 853, 864 (Fed. Cir. 1985), *cert. denied*, 475 U.S. 1016 (1986); *Paper Converting Mach. Co.* v. *Magna-Graphics Corp.*, 745 F.2d 11, 21 (Fed. Cir. 1984).

In order to recover lost profits Pall must show: (1) a demand for the patented product; (2) the absence of acceptable noninfringing substitutes; (3) the manufacturing and

marketing capability to exploit the demand; and (4) the amount of profit it would have made. *Panduit Corp.* v. *Stahlin Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1156 (6th Cir. 1978). This method of proof, also called the *Panduit* test, has been accepted by the Court of Appeals for the Federal Circuit. *Bio-Rad Lab. Labs., Inc.* v. *Nicolet Instrument Corp.*, 739 F.2d 604, 616 (Fed. Cir.), *cert. denied*, 469 U.S. 1038 (1984). *See also State Indus.*, 883 F.2d at 1577 (approving modified version of *Panduit* test).

As part of the lost profits analysis courts rely on what has become known as the incremental income approach. *Paper Converting Mach. Co.*, 745 F.2d at 22. That approach has been adopted in this district by my colleague, Judge Harrington, in *King Instrument Corp. v. Perego*, 737 F. Supp. 1227, 1242 (D. Mass. 1990). This Court is not bound to follow the analysis of another judge in the district but the Court is not inclined to reinvent the wheel, either, and where there is a persuasive analysis of a point by one's colleague in the same district, matters of comity and equality among litigants – as Judge Wyzanski put it – strongly incline the Court toward following the same analysis, and this Court does so. Wyzanski, "The Essential Qualities of a Judge," from The New Meaning of Justice (1956), reprinted in Handbook for Judges 96 (American Judicature Society 1975).

At the close of Pall's case on damages, this Court opined that 25 percent of the total MSI nylon sales market appeared to be an accurate calculus, for purposes of damages, of the lost sales that Pall would have made. On reflection, this calculus seemed overly generous to Pall because it instantaneously awarded 25 percent of the MSI

sales to that competitor. It then seemed that an appropriate analysis, consistently drawing appropriate and fair inferences from the facts, would have been to start with a Pall penetration of the MSI market at approximately five percent per year, five percent in '83, ten percent in '84, 15 percent in '85, 20 percent in '86, stabilizing at 25 percent thereafter.

Ultimately, however, this Court has come to believe that this incremental approach is too crabbed a construction of the market share that Pall would have attained in the absence of infringement. The Court has in mind specifically that the MSI cartridges did not meet the requirements of the pharmaceutical industry. MSI has published various advertising materials in advance of the actual development of certain membranes. In certain instances the MSI materials could not pass the pharmaceutical tests and thus MSI has not made significant sales to the pharmaceutical industry, notwithstanding advertisements which represent that the applicable tests were passed. It seems likely, therefore, that Pall is, and was at all material times, positioned to garner the bulk of that market. Likewise, Cuno was not in the disk market at all.

On the other hand, two critical points tend to limit Pall's market share, even in the absence of infringement. They are these. First, there is a significant price differential between the prices of Pall's items and the prices of MSI's items. Some of Pall's items are fifty percent higher in price than the corresponding MSI item. The Court infers that with such a price differential some people will refuse to buy from Pall at all, even if it is the only supplier, and they will no longer be part of the market.

Others will look for a less workable but perhaps acceptable substitute. Second, as one comes to dominate a market more completely, as it appears Pall dominates the cartridge and disk markets for nylon materials, a party who is capable of entering that market like Cuno, is more inclined to do so if they can undercut Pall's price at all. Due to Pall's efforts, such a producer knows there is a market for that item. As owner of the Marinaccio patent, Cuno, having settled with Pall, knows it can go forward without fear of a patent suit, if it can produce the item at a lesser price.

The incremental income analysis is an appropriate method for calculating lost profits. *See Paper Converting Mach. Co.*, 745 F.2d at 22; *King Instrument Corp.*, 737 F. Supp. at 1242. In arriving at a figure for lost profits, the Court rejects Pall's suggestion that its average profitability is 67.2 percent. With respect to the transfer membrane market, Pall would have to tool up to meet the bulk of what MSI was doing. Pall has failed to meet its burden of proving that its research and development costs would be as small as were testified to, and that its direct material costs would not be greater than was testified to. Taking these matters into account, the Court finds that the incremental profitability of Pall's items is 45 percent.

This, therefore, leads the Court to conclude that lost sales of 25 percent for each year, starting in 1983, is an appropriate and reasonable inference, having in mind the various variables just discussed. When coupled with an incremental profitability of 45 percent, Pall's lost profits are calculated at $ 2,013,466 as set forth in the third column in this spreadsheet, Appendix B.

2. Royalty Damages

In calculating a reasonable royalty, the Court follows the criteria set forth in *Georgia-Pacific Corp.* v. *U.S. Plywood Corp.*, 318 F. Supp. 1116 (S.D.N.Y. 1970), *modified*, 446 F.2d 295 (2d Cir.), *cert. denied*, 404 U.S. 870 (1971). The fifteen factors relevant to a determination of a reasonable royalty have all been considered by the Court here.[11]

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[11] As stated by the court in *Georgia-Pacific*, those factors are as follows:

> The royalties received by the patentee for the licensing of the patent in suit . . . [,] [t]he rates paid by the licensee for the use of other patents comparable to the patent in suit[,] [t]he nature and scope of the license, as exclusive or non-exclusive; or as restricted or non-restricted in terms of territory or with respect to whom the manufactured product may be sold[,] [t]he licensor's established policy and marketing program to maintain his patent monopoly . . . [,] [t]he commercial relationship between the licensor and licensee . . . [,] [t]he effect of selling the patented specialty in promoting sales of other products of the licensee . . . [,] [t]he duration of the patent and the term of the license[,] [t]he established profitability of the product made under the patent; its commercial success; and its current popularity[,] [t]he utility and advantages or the patent property over the old modes or devices, if any, that had been used for working out similar results[,] [t]he nature of the patented invention; the character of the commercial embodiment of it as owned and produced by the licensor; and the benefits to those who have used the invention[,] [t]he extent to which the infringer has made use of the invention; and any evidence probative of the value of that use[,] [t]he portion of the profit or of the selling price that may be customary in the particular business or in comparable

Application of the 15 part test of *Georgia-Pacific*, 318 F. Supp. at 1120, indicates that a royalty of eight percent is appropriate. The Court accordingly makes the findings in column four of the spreadsheet, Appendix B. Royalty damages thus aggregate $ 1,073,849.

3. Prejudgment Interest

With respect to prejudgment interest, the Court rules that, "absent some justification for withholding such an award," prejudgment interest should be awarded both on the lost profits and reasonable royalty portions of the damage award. *General Motors Corp.* v. *Devex Corp.*, 461 U.S. 648, 657 (1983). Setting prejudgment interest at the prime rate, the Court makes the findings set forth in the fifth column of the spreadsheet, Appendix B. Prejudgment interest thus aggregates $ 848,955.

4. Willfulness

Willfulness must be proved by clear and convincing evidence in order to justify increased damages under 35 U.S.C. § 284 (1988). *E.I. Du Pont de Nemours & Co.* v.

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> businesses to allow for the use of the invention or analogous inventions[,] the portion of the realizable profit that should be credited to the invention . . . [,] [t]he opinion testimony of qualified experts[,] [t]he amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement[.]

*Georgia-Pacific*, 318 F. Supp. at 1120.

*Phillips Petroleum Co.*, 849 F.2d 1430, 1440 (Fed. Cir.), *cert. denied*, 488 U.S. 986 (1988). This determination is to be made on the basis of the totality of the circumstances. It must be shown that the "infringer had no reasonable basis for believing it had a right to do the acts." *Stickle v. Heublein, Inc.*, 716 F.2d 1550, 1565 (Fed. Cir. 1983); *See also, State Indus., Inc.* v. *A.O. Smith Corp.*, 751 F.2d 1226, 1237 (Fed. Cir. 1985); *American Original Corp.* v. *Jenkins Food Corp.*, 774 F.2d 459, 465 (Fed. Cir. 1985).

Here recognizing that MSI has intentionally sought to design around the Pall patent but has, in fact, made extraordinarily extensive use of that patent in its own process, and having in mind that counsel was not consulted to give an opinion about the infringement or lack thereof, this case would appear to be a candidate for increased damages based on willfulness. Nevertheless, the Court rules that, in the main, there ought not be any increased damages for willfulness here. The Court reaches that result through the following analysis.

Failure to consult counsel is but one factor that may be considered in determining willfulness. *American Original*, 774 F.2d at 465; *Ryco, Inc.* v. *Ag-Bag Food Corp.*, 857 F.2d 1418, 1428 (Fed. Cir. 1988). In this case, the failure to consult counsel is not terribly troublesome. The Court sees no reason that counsel ought monopolize knowledge about these matters. Inventors ought not be penalized simply because they don't go to counsel. Here MSI's people are experienced in the industry. They made significant efforts to avoid the claims of the patent. They have avoided the process claims in the case of Nylon 66, and both the product and process claims so far as Nylon 46

goes. MSI is liable here only through the application of Doctrine of Equivalents.

What's more, the application of the Doctrine of Equivalents here is not free from doubt as to the process claims, both as to Nylon 66 and Nylon 46. The matter is a complex one to which the Court has given a great deal of thought. Taking all these aspects into account, the Court does not find, in the main, that there should be any increased damages with respect to willfulness.

There is this one exception. In October, 1989, MSI began producing its product line, primarily using Nylon 46, a product which the Court has already found MSI utilized to avoid the Pall patent. What's more, it switched to Nylon 46 during the course of vigorous and active litigation in this case, during a period when it's clear that it was advised by competent and knowledgeable patent counsel. Even after it switched to Nylon 46, however, on occasion it continued to manufacture items using Nylon 66.

It must have been apparent to MSI by October, 1989, given its extensive research efforts and the involvement of its patent counsel, that Nylon 66 infringed the product claims of the patent-in-suit. To that extent – the manufacture by MSI after October, 1989, of microporous membrane using Nylon 66 – the damages that stem from such manufacture are declared to be willful.

In cases where willfulness is found, it is a separate and distinct determination whether increased damages should be awarded. *Modine Mfg. Co.* v. *Allen Group, Inc.*, 917 F.2d 538, 543 (Fed. Cir. 1990), *cert. denied*, 111 S. Ct. 2017 (1991); *Ryco, Inc.*, 857 F.2d at 1429; *Kloster Speedsteel*

*AB* v. *Crucible, Inc.*, 793 F.2d 1565, 1580 (Fed. Cir. 1986), *cert. denied*, 479 U.S. 1034 (1987). Here, having heard the damages evidence, the Court doubles, but does not treble, the damages with respect to the willful infringement of the Pall patent by the use of Nylon 66 in the manufacture of microporous membranes through the 1990 fiscal year and the 1991 fiscal year to April 2nd, 1991. The additional damages resulting from the willful infringement come to $ 198,021.

5. Attorneys Fees

The award of attorneys' fees under the patent law is reserved for those exceptional cases where there has been conduct so egregious that as an equitable matter, the award of attorneys' fees is appropriate. 35 U.S.C. § 285 (1988). While the matter is within the discretion of the Court, such discretion may be exercised only upon a specific finding of exceptional circumstances. *Beckman Instruments, Inc.* v. *LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989). Such circumstances include inequitable conduct in the manner of conducting the litigation. *See, e.g., Bayer Aktiengesellschaft*, 738 F.2d at 1242; *Hughes* v. *Novi American, Inc.*, 724 F.2d 122, 124-25 (Fed. Cir. 1984).

This case is such an exceptional case because, when faced by clear requests for discovery of the use of Nylon 46, MSI, nevertheless, refused to make discovery and instead concealed its refusal by making discovery which did not go so far as to disclose the use of Nylon 46 although MSI well knew it was using Nylon 46 in its manufacturing process and must have understood the

reach of the discovery requests. MSI wrongfully arrogated to itself the determination of relevance.

That being so, Pall is awarded so much of its attorneys' fees as are addressed solely to the prosecution of the case as to the use of Nylon 46.

First, the Court is satisfied that under the patent laws the attorneys' fees portion of an award can include the actual costs for testifying expert witnesses and their participation in preparation, testing, and testifying with respect to the case.

Here, the Court excludes from the calculus any sum having to do with Mr. Petran simply because his work was really done and the heavy lifting of his job completed before Nylon 46 came into the case. Not so for Dr. Kesting. The Court has included the expenses of Dr. Kesting in the calculus adopted here.

The Court expressly rejects the suggestion that this case has been overstaffed in any way. Looking back to those days, now some 14 years ago, when I was in practice, this Court is quick, perhaps too quick on occasion, to perceive what it believes to be overstaffing of a case. Perhaps that's wrong. But while there are cases that are overstaffed, this is not one of them. In this case, the Court appreciates the clear delegation of responsibility and the division in the presentation of the case – Mr. Hartmann's concentration on the liability aspects, Mr. Phelps' concentration on the damage aspects, and Mr. Field's concentration on matters of local practice. At each turn, since this Court has had the responsibility for this case, Pall has been assiduous in providing the Court with the documentary support for its contentions in a timely, efficient,

useful fashion. The premarking of documents, the manner in which they were cataloged, the prompt submission of briefs on matters of the Court's interest – all of those things convince the Court that there's been no overstaffing of this case; rather, there has been a lawyer-like presentation of the evidence.

While there's been no overstaffing, the Court does not simply adopt the submissions as to attorneys' fees that are made here. The Court's analysis recognizes, as the plaintiffs themselves concede, that estimates must be made taking into account the incremental advantages gained from the attorney's familiarity with the Nylon 46 case gained through the careful presentation of the Nylon 66 case. After evaluating the quality of the presentation before the Court, including Dr. Kesting's contribution, the complexity of the evidence, and the nature of these legal services in the patent marketplace generally, the Court awards attorneys' fees of $ 300,000.

6. Sanctions

The failure to make disclosure relative to Nylon 46, and the prolongation of the litigation as a result, has been the subject of an order of sanctions by this Court, an order which was later modified to exclude, on the clear record, any aspersions as to the conduct of Mr. Halpern and Ms. Shea here in Boston. That order was conditioned on Pall failing to get any recovery with respect to the production of microporous membrane using Nylon 46. Since Pall has recovered for the infringement which prescinds from the production of such membrane using Nylon 46, the sanction has never come into effect either

as against Mr. Huettner nor as against MSI. On that basis, therefore, there's no sanction to be assessed as against MSI or Mr. Huettner.

7. Total Damages

As set forth in the spreadsheet, Appendix B, the aggregate of these damage findings is $ 4,434,291.

## CONCLUSION

In accordance with the foregoing discussion the Court entered, and partially stayed, a judgment setting forth the above described injunctive relief as well as damages of $ 4,434,291, interest, and costs.

WILLIAM G. YOUNG
UNITED STATES
DISTRICT JUDGE

## APPENDIX A

### The Asserted Claims of Pall's '479 Patent

Pall asserts that MSI has infringed the following set of claims of the Pall '479 patent by its manufacture and sales of microporous membrane made from nylon 66:

### NYLON GROUP CLAIMS

### MEMBRANE SHEET CLAIMS

34. A skinless alcohol-insoluble polyamide resin membrane sheet of alcohol-insoluble hydrophobic polyamide resin selected from the group consisting of polyhexamethylene adipamide, polyhexamethylene sebacate, and poly-ε-caprolactam, and capable when completely immersed in water of being wetted through within no more than one second, and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water.

35. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 34 having through pores extending from surface to surface that are substantially uniform in shape and size.

37. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 34 having absolute particle removal ratings of 0.10 μM to 5 μM.

48. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 34 having a thickness within the range from about 0.025 to about 0.8 millimeter.

FILTER ELEMENT CLAIMS

49. A filter element comprising a hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 34 formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight.

50. A filter element according to claim 49 in which the sheet is corrugated.

55. A filter element according to claim 49 in which the end caps are of polyester resin and the filter element including the end caps is hydrophilic and rapidly wetted by water.

56. A filter element according to claim 55 in which the polyester is polybutylene glycol terephthalate.

PROCESS CLAIMS

1. A process for preparing skinless hydrophilic alcohol-insoluble polyamide membranes that are readily wetted by water which comprises preparing a solution of an alcohol-insoluble polyamide resin selected from the group consisting of polyhexamethylene adipamide, polyhexamethylene sebacate, and poly-ε-caprolactam in a polyamide resin solvent, inducing nucleation of the solution by controlled addition to the solution of a nonsolvent for the polyamide resin, under controlled conditions of concentration, temperature, addition rate, and degree of agitation to obtain a visible precipitate of polyamide resin

particles, thereby forming a casting solution; spreading the casting solution on a substrate to form a thin film thereof on the substrate; contacting and diluting the film of casting solution with a nonsolvent liquid for the polyamide resin, thereby precipitating polyamide resin from the casting solution in the form of a thin skinless membrane; washing the membrane to remove solvent; and drying the resulting membrane.

2. A process according to claim 1 in which precipitated polyamide resin particles are redissolved before spreading the casting solution on a substrate.

3. A process according to claim 1 in which precipitated polyamide resin particles are filtered out before spreading the casting solution on a substrate.

4. A process according to claim 1 in which part of the precipitated polyamide resin particles are redissolved and part are filtered out before spreading the casting solution on a substrate.

5. A process according to claim 1 in which the nonsolvent used to contact and dilute the casting solution is a mixture of solvent and nonsolvent liquids containing a substantial proportion of the solvent liquid, but less than the proportion in the casting solution.

10. A process according to claim 1, in which the polyamide resin solution film is contacted with the nonsolvent by immersing the film carried on the substrate in a bath of nonsolvent liquid.

11. A process according to claim 10 in which the bath comprises both solvent and nonsolvent liquids.

12. A process according to claim 11 in which the bath comprises an amount within the range from about 20% to about 55% of a solvent for the resin; washing the resulting membrane substantially free of solvent; and drying the membrane.

21. A process according to claim 1 in which the casting and precipitating temperatures are within the range from about 10 degrees C to the boiling temperature of the lowest boiling solvent or nonsolvent component present.

22. A process according to claim 1 in which the casting resin solution is clear, and free from suspended material, before being spread upon the substrate to form a film.

24. A process according to claim 1 in which the substrate is not stripped from the polyamide resin membrane before drying, and after drying remains attached to the polyamide resin membrane.

26. A process according to claim 1 in which the substrate is of polyester resin.

27. A process according to claim 1 in which the casting solution has a viscosity within the range from about 500 centipoises to about 100,000 centipoises at the temperature existing at the time it is cast as a film.

28. A process according to claim 1 in which the casting solution has a viscosity within the range

from about 500 centipoises to about 5000 centipoises at the temperature existing at the time it is cast as a film.

## RATIO RANGE CLAIMS

### MEMBRANE SHEET CLAIMS

116. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet of alcohol-insoluble hydrophobic polyamide resin having a ratio $CH_2$:NHCO of methylene $CH_2$ to amide NHCO groups within the range from about 5:1 to about 7:1; capable when completely immersed in water of being wetted through within no more than one second, and reverting when heated to a temperature just below the softening temperature of the membrane to a hydrophobic material which is no longer wetted by water.

117. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 116 having through pores extending from surface to surface that are substantially uniform in shape and size.

119. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 116 having absolute particle removal ratings of 0.10 μ to 5 μ.

132. A hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 116 having a thickness within the range from about 0.025 to about 0.8 millimeter.

FILTER ELEMENT CLAIMS

133. A filter element comprising a hydrophilic skinless alcohol-insoluble polyamide resin membrane sheet according to claim 116 formed in a tubular configuration with the ends of the tube sealed to end caps of which at least one end cap has a central aperture giving access to the interior of the tube, and with the sides of the sheet lapped and sealed together, all seals being fluid-tight.

134. A filter element according to claim 133 in which the sheet is corrugated.

139. A filter element according to claim 133 in which the end caps are of polyester resin and the filter element including the end caps is hydrophilic and rapidly wetted by water.

140. A filter element according to claim 139 in which the polyester is polybutylene glycol terephthalate.

PROCESS CLAIMS

77. A process for preparing skinless hydrophilic alcohol-insoluble polyamide membranes that are readily wetted by water which comprises preparing a solution in a polyamide solvent of an alcohol-insoluble polyamide resin having a ratio $CH_2$:NHCO of methylene $CH_2$ to amide NHCO groups within the range from about 5:1 to about 7:1; inducing nucleation of the solution by controlled addition to the solution of a nonsolvent for the

polyamide resin, under controlled conditions of concentration, temperature, addition rate, and degree of agitation to obtain a visible precipitate of polyamide resin particles, thereby forming a casting solution; spreading the casting solution on a substrate to form a thin film thereof on the substrate; contacting and diluting the film of casting solution with a nonsolvent liquid for the polyamide resins, thereby precipitating polyamide resin from the casting solution in the form of a thin skinless hydrophilic membrane; washing the membrane to remove solvent; and drying the resulting membrane.

78. A process according to claim 77 in which precipitated polyamide resin particles are redissolved before spreading the casting solution on a substrate.

79. A process according to claim 77 in which precipitated polyamide resin particles are filtered out before spreading the casting solution on a substrate.

80. A process according to claim 77 in which part of the precipitated polyamide resin particles are redissolved and part are filtered out before spreading the casting solution on a substrate.

81. A process according to claim 77 in which the nonsolvent used to contact and dilute the casting solution is a mixture of solvent and nonsolvent liquids containing a substantial proportion of the solvent liquid, but less than the proportion in the casting solution.

91. A process according to claim 77 in which the polyamide resin solution film is contacted

with the nonsolvent by immersing the film carried on the substrate in a bath of nonsolvent liquid.

92. A process according to claim 91 in which the bath comprises both solvent and nonsolvent liquids.

93. A process according to claim 92 in which the bath comprises an amount within the range from about 20% to about 55% of a solvent for the resin; washing the resulting membrane substantially free of solvent; and drying the membrane.

103. A process according to claim 77 in which the casting and precipitating temperatures are within the range from about 10 degrees C to the boiling temperature of the lowest boiling solvent or nonsolvent component present.

104. A process according to claim 77 in which the casting resin solution is clear, and free from suspended material, before being spread upon the substrate to form a film.

106. A process according to claim 77 in which the substrate is not stripped from the polyamide resin membrane before drying, and after drying remains attached to the polyamide resin membrane.

108. A process according to claim 77 in which the substrate is of polyester resin.

109. A process according to claim 77 in which the casting solution has a viscosity within the range from about 500 centipoises to about 100,000 centipoises at the temperature existing at the time it is cast as a film.

110. A process according to claim 77 in which the casting solution has a viscosity within the range from about 500 centipoises to about 5000 centipoises at the temperature existing at the time it is cast as a film.

Pall asserts that MSI has infringed nylon group claims Nos. 34, 35, 37, 48, 1, 2, 5, 10, 11, 12, 21, 22, 24, 26, 27, and 28 and the corresponding ratio range claims Nos. 116, 117, 119, 132, 77, 78, 81, 91, 92, 93, 103, 104, 106, 108, 109, and 110 of the Pall '479 patent by its manufacture and sales of microporous membrane made from nylon 46.

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# APPENDIX B

## PALL V. MSI DAMAGES

## JUDGE YOUNG 6/20/91 DAMAGES FINDINGS

| FISCAL YEAR ENDED 10/31 | TOTAL MSI NYLON SALES * | PALL LOST PROFITS | ROYALTY DAMAGES |
|---|---|---|---|
| 1983 | $ 105,000 | $ 11,813 | $ 6,300 |
| 1984 | 375,000 | 42,188 | 22,500 |
| 1985 | 915,000 | 102,938 | 54,900 |
| 1986 | 1,491,797 | 167,827 | 89,508 |
| 1987 | 2,065,011 | 232,314 | 123,901 |
| 1988 | 2,909,226 | 327,288 | 174,554 |
| 1989 | 3,487,478 | 392,341 | 209,249 |
| 1990 | 3,762,395 | 423,269 | 225,744 |
| 1991 | 2,786,572 | 313,489 | 167,194 |
| TOTAL | $ 17,897,479 | $ 2,013,466 | $ 1,073,849 |

| FISCAL YEAR ENDED 10/31 | PRE-JUDGMENT INTEREST | NYLON 66 WILLFULNESS DAMAGES ** | TOTAL DAMAGES |
|---|---|---|---|
| 1983 | $ 20,192 | | $ 38,305 |
| 1984 | 58,102 | | 122,790 |
| 1985 | 111,702 | | 269,540 |
| 1986 | 144,005 | | 401,340 |
| 1987 | 156,592 | | 512,806 |
| 1988 | 163,952 | | 665,793 |
| 1989 | 124,649 | | 726,239 |
| 1990 | 60,099 | 180,426 | 889,538 |
| 1991 | 9,662 | 17,595 | 507,941 |
| TOTAL | $ 848,955 | $ 198,021 | $ 4,134,291 |
| | | 46 ATTORNEYS FEES | 300,000 |
| | | GRAND TOTAL | $ 4,434,291 |

ASSUMPTIONS:

1. PALL LOST SALES OF 25% OF TOTAL MSI NYLON SALES
2. PALL INCREMENTAL PROFITABILITY OF 45%
3. ROYALTY RATE OF 8%
4. PRE-JUDGMENT INTEREST COMPUTED USING PRIME RATE
5. 1990-91 NYLON 66 DAMAGES THROUGH 4/2/91 DOUBLED (BEFORE INTEREST)

* MSI NYLON SALES ESTIMATED THROUGH 6/19/91

** ADDITIONAL DAMAGES ONLY

**Brief for Appellant, Micron Separations, Inc.**

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UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

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No. 91-1393, -1394, -1409

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PALL CORPORATION,

Plaintiff/Cross-Appellant

v.

MICRON SEPARATIONS, INC.,

Defendant-Appellant.

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ON APPEAL FROM A JUDGMENT OF THE
UNITED STATES DISTRICT COURT FOR THE
DISTRICT OF MASSACHUSETTS

(Judge William G. Young)

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*Separations, Inc.*
*Defendant-Appellant*

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* * *

## IV. STATEMENT OF ISSUES

1. Did the district court err as a matter of law when it held that MSI infringed claims of the Pall patent because MSI had taken "the zest of the art of the learning" of the Pall patent to design around it, and that it was therefore irrelevant that critical limitations of the claims were absent from the accused processes and products?

2. Did the district court err as a matter of law when it held that prosecution history estoppel did not apply to limiting arguments made to obtain allowance of claims in response to a 35 U.S.C. § 112 enablement rejection?

3. Did the district court err as a matter of law in holding that changes MSI made after commencement of this lawsuit to create a new product in further avoidance of claim readability constituted evidence of willful infringement regarding the continued sale of the prior product?

* * *

## VII. ARGUMENT

### A. Standard of Review.

MSI does not challenge here on appeal any of the district court's underlying findings of fact regarding infringement. Therefore, as in *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1547, 220 U.S.P.Q. 303, 308 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984), it is unnecessary for this Court to set aside any probative fact found by the district court or to engage in any reweighing of the evidence in this case.

## SETTLEMENT AGREEMENT

**THIS AGREEMENT,** effective as of the 10th day of May, 1990, by and between PALL CORPORATION, a New York Corporation, having an office at 30 Sea Cliff Avenue, Glen Cove, New York 11542 (hereinafter called "Pall"), and CUNO, INCORPORATED, a Connecticut Corporation, having an office at 400 Research Parkway, Meriden, Connecticut 06450 (hereinafter called "Cuno").

## WITNESSETH

**WHEREAS,** Pall and Cuno were engaged in 1) an action designated "Cuno, Inc. v. Pall Corporation, et al., Civil Action No. 86-3197," in the United States District Court for the Eastern District of New York (hereinafter called the "U.S. Action") which was dismissed with prejudice as to all claims and counterclaims on May 10, 1990 pursuant to the "Points of Agreement", executed by the parties on that day, which is annexed hereto as Exhibit A and incorporated herein, 2) certain U.S. Interferences (as defined hereafter), and 3) certain Foreign Actions and Oppositions (as defined hereafter) relating to nylon microporous membranes.

**WHEREAS,** Cuno represents that it has the authority to make the agreements herein contained in respect to the U.S. and foreign patent applications and patents identified herein;

**WHEREAS,** Pall represents that it has the authority to make the agreements herein contained in respect to the U.S. and foreign patent applications and patents identified herein;

NOW, THEREFORE, in the light of the unknown outcome of the U.S. Action, the U.S. Interferences and the Foreign Actions and Oppositions and in order to avoid the costs associated with reaching a final resolution in all such matters and further in order to reach a worldwide resolution of all such matters, the parties agree to the following:

## ARTICLE I – DEFINITIONS

1.1 The term "Affiliate" as used herein with respect to any corporation shall mean and include all persons and entities who control such corporation or who are under common control with such corporation or who are controlled by such corporation. "Control" or "controlled" with respect to any corporation means ownership, directly or indirectly, of fifty percent (50%) or more of the voting stock thereof.

1.2 "U.S. Interferences" shall mean U.S. Patent and Trademark Office Interference Nos. 102,213 and 102,214.

1.3 "Foreign Actions and Oppositions" shall mean the following matters:

A. Litigation

1. United Kingdom

a. Pall Corp. v. Commercial Hydraulics (Bedford) Ltd., Cuno Europe, and Cuno Inc. (CH 1987-P-No. 2931).

b. Cuno Inc. v. Pall Process Filtration Ltd. and Pall Europe Ltd. (CH 1988-C-No. 9278).

2. West Germany

   a. Pall Deutschland GmbH v. Cuno Europe SA (No. 70 16481/87).

   b. Cuno Europe S.A. v. Pall Filtrationstechnik GmbH, Otto H. Kauke, H.V. Hensgen, and R. Kaiser (No. 7 0 7800/88)

3. France

   a. Pall Corp. v. F.L.O.T., Cuno Europe SA, and Cuno Inc. (Third Chamber, 2nd Section – No. 58266).

B. Oppositions

1. Japan

   a. Cuno Opposition to Pall's Japanese Ultipor Patent Application No. 231983/79 (Patent Pub. No. 7802/89).

   b. Cuno's Opposition to Pall's Japanese Posidyne Patent Application No. 17308/83.

   c. Cuno's Opposition to Pall's Japanese Carboxydyne Patent Application No. 17309/83.

2. EPO

   a. Cuno's Opposition to Pall's EPO Posidyne Patent Application No. 83.300518.4 (Patent Pub. No. 0090483).

   b. Cuno's Opposition to Pall's EPO Ultipor Patent 0,005,536.

   c. Cuno's Opposition to Pall's EPO Carboxydyne Patent Application

No. 83.300517.6 (Patent Pub. No. 0087228).

1.4 "Patent Rights" shall mean all patents identified herein, any patents maturing out of the applications identified, and any continuations, divisions, reexaminations, reissues, extensions foreign cognates or foreign counterparts thereof.

## ARTICLE II – PATENT LICENSE

2.1 Cuno, Inc., in consideration of payment by Pall Corporation of $12,000,000 and other valuable consideration, the receipt of which is hereby acknowledged, grants Pall Corporation and its Affiliates a fully paid up license under U.S. Patents 4,473,474, 4,673,504, 4,708,803, and 4,711,793 and any continuations, divisions, reexaminations, reissues, extensions, foreign cognates or foreign counterparts thereof. The license shall be subject to an exclusive license from Cuno to Rohm & Haas dated May 2, 1986 to use and sell certain hollow tube or fiber products.

## ARTICLE III – RELEASES FOR PAST ACTIVITIES

3.1 Cuno, for itself, its successors, assigns and Affiliates, hereby remises, releases and forever discharges Pall and its Affiliates (as of the date of this Agreement) and their past and present officers, directors, employees and agents from any and all claims, causes of action, suits, debts, dues, sums of money, accounts, reckoning, bonds, bills, specialties, covenants, contracts, controversies, agreements, promises, variances, trespasses, damages, judgments, extends, executions, claims and demands

whatsoever, in law or equity, known or unknown (except for obligations under this agreement) which it or any of the foregoing ever had or now has upon or by reason of any and all activities in connection with nylon membrane products anywhere in the world up to and including the Effective Date of this Settlement Agreement.

3.2 Pall, for itself, its successors, assigns and Affiliates, hereby remises, releases and forever discharges Cuno and its Affiliates (as of the date of this Agreement) and their past and present officers, directors, employees and agents from any and all claims, causes of action, suits, debts, dues, sums of money, accounts, reckoning, bonds, bills, specialties, covenants, contracts, controversies, agreements, promises, variances, trespasses, damages, judgments, extends, executions, claims and demands whatsoever, in law or equity, known or unknown (except for obligations under this agreement) which it or any of the foregoing ever had or now has upon or by reason of any and all activities in connection with nylon membrane products anywhere in the world up to and including the Effective Date of this Settlement Agreement.

## ARTICLE IV – COVENANTS

4.1 Cuno covenants that it will not in the future initiate or prosecute any action against Pall Corporation or its Affiliates under Cuno U.S. Patent 3,876,738 or any patent(s) which matures out of U.S. Application Serial No. 06/589,895 filed March 15, 1984 or any continuations, divisions, reexaminations, reissues, extensions, foreign cognates or foreign counterparts thereof. In the case of

any Pall Affiliates not extant or affiliated with Pall as of the Effective Date of this Agreement, the foregoing covenant not to sue shall apply only to the activities of such Affiliate from the date of any affiliation forward. The covenant with respect to U.S. Patent 3,876,738 shall be subject to an exclusive license under such patent from Cuno to Rohm & Haas dated May 2, 1986 to use and sell certain hollow tube or fiber products.

4.2 Pall covenants that it will not in the future initiate or prosecute any action against Cuno Inc. or its Affiliates under Pall U.S. Patents 4,340,479, 4,702,840 or 4,707,266, or any continuations, divisions, reexaminations, reissues, extensions, foreign cognates or foreign counterparts thereof. In the case of any Cuno Affiliates not extant or affiliated with Cuno as of the Effective Date of this Agreement, the foregoing covenant not to sue shall apply only to the activities of such Affiliate from the date of any affiliation forward.

* * *